JOURNAL

OF THE

BOARD OF AGRICULTURE

OF

BRITISH GUIANA.

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MEETING OF THE BOARD OF AGRICULTURE

A Meeting of the Board of Agriculture was held in the Court of Policy Hall on Friday, the 26th day of February, 1926, at 2.30 p.m. His Excellency the Governor, Sir Cecil Rodwell, K.C.M.G., presided, and there were present W. Francis, Esq., F.I.C., Acting Chairman, (Acting Director of Science and Agriculture), Hon. G. D. Bayley, C.B.E. (Commissioner of Lands and Mines), S. H. Bayley Esq., (Director, Colonial Transport Department), L. D. Cleare, Jr., Esq., F.E.S. (Government Economic Biologist), Dr. C. L. Whittles, (Superintendent, British Guiana Sugar Planters' Experiment Stations), G. E. Anderson, Esq. (Representative of the Royal Agricultural and Commercial Society), Captain E. Beckett, F.L.S. (Deputy Director of Agriculture for Essequibo), Hon. R. E. Brassington, Hon. J. J. da Silva, H. L. Humphrys, Esq , E. M. Walcott, Esq., F.R., A. Seton Milne, Esq., (Government Veterinary Surgeon), H. A. Britton, Esq. (President of the British Guiana Farmers' Conference) Dr. F. T. Wills, C. R. Williams, Esq., with Mr. E. M. Peterkin, Secretary.

Mr. Humphrys welcomed His Excellency on behalf of the Board, and expressed the hope that he would find time to attend other meetings.

Mr. da Silva endorsed Mr. Humphrys' remarks and added that knowing as he did that His Excellency

was travelling over the country and seeing conditions for himself, his attendance at the meetings of the Board would be very useful.

His Excellency: I must thank Mr. Humphrys and Mr. da Silva for the very kind words with which they have welcomed me. This is the first occasion on which I am presiding at a meeting of this Board, I understand it is not the practice for the Governor, although he is the President of the Board to attend the meetings unless they are special meetings. I am glad however, as this is the first meeting to be held since I have arrived in the Colony, to preside, and I shall certainly have no hesitation in presiding on future occasions if there is any special reason why I should do so.

The Acting Chairman tendered excuses on behalf of W. M. B. Shields, Esq., R. Strang, Esq., and the Director of Co-operative Societies (G.L.B. Gall, Esq.).

The minutes of the previous meeting held on September, 30th, 1925, having been circulated to the Members of the Board and having received their approval were on the motion of Mr. H. L. Humphrys, seconded by Mr. S. H. Bayley, taken as read and confirmed.

His Excellency said: Before the Board proceeds with its business I am going to ask you to agree to a resolution with reference to the death of Sir John Harrison. Sir John Harrison, the late Chairman of the Board died on the 8th of February, after 36 years' service in the Colony. Before arriving here in 1889 he served for over ten years in Barbados as Island Professor of Chemistry and Agricultural Science. He became Director of Science and Agriculture in 1905, was created C.M.G., in 1901 and Knighted in 1921. He also held the appointments of Chairman of the Board of Agriculture, Government Analyst and Geologist, Chairman of the B.G. Sugar Planters' Experiment Stations Committee, and was *ex officio*, a Director of the Royal Agricultural and Commercial Society. He was made a member of the Executive Council in 1918. As Chairman of the Board of Agriculture he was present at every meeting held from its inception on the 9th.

of August, 1901, except two, one in 1921 and one in 1922, when he was away from the Colony on leave of absence through ill-health. My own official association with the late Professor Harrison was but a brief one, extending only over a few weeks before he was taken ill, but I saw enough of his work to realize what a loss the Colony and Government have sustained. I do not think that I can describe him better than by the words used by the Secretary of State for the Colonies in the Telegrams of condolence which he sent the other day. Mr. Amery referred to Sir John Harrison 'as an officer of exceptional distinction.' Sir John Harrison carried on his work to the very last moment. In fact, it was only by my express orders that he could be induced to lay aside his work. Even as late as the 27th, January there is a minute on record by him about certain details of departmental administration, a minute which I may say displays all the force and virility which I believe usually characterised the product of his pen and I should like to say that I am indebted to the late Sir John Harrison for advice which he gave me the last time I had an official interview with him with regard to the re-organisation of the Department of Science and Agriculture as from the date when it was then hoped he would retire in order to enjoy the leisure which he had so well earned. The following is the resolution which I will ask the Board to pass and I suggest that out of respect we should pass it standing:—

"That the British Guiana Board of Agriculture
" desires to record its sense of the great loss sustained
" by the Colony and especially the agricultural interests
" in the lamented death of the late Chairman of the
" Board, Sir John Harrison, C.M.G., etc , and desires to
" convey its deep sympathy and condolence to Lady
" Harrison and other members of his family.'

Mr. Brassington: Your Excellency, I have the very great privilege in seconding this resolution bearing testimony to the great services Sir John Harrison rendered to this Colony. I knew Sir John Harrison as far back as 1900 and from that date up to the date

of his death, I have been associated with him on many public boards. I say in the fullest sense that it was a privilege to be permitted to be associated with Sir John Harrison on any board or in any policy or public duty. As I said in the Combined Court at the annual session I do not suppose there was anybody in the scientific world who had the number of degrees and whose scientific attainments were so varied as Sir John Harrison. In agricultural science and anything that he took up, his services were of the greatest value to the Colony, and when we consider the numerous offices he held one cannot understand how he did it. He had a most marvellous memory and capacity for work that has never been excelled or equalled in this Colony. I feel certain that the remarks which fell from Your Excellency will be endorsed by every member of the Board and in this Colony, and, on this Board his memory will long live.

The motion was carried standing.

Mr. Walcott moved that the Board place on record its regret and sympathy with respect to the death of Mr. B. Gainfort, retired Chief Commissary, who, he said, had served the Colony for many years and was never afraid to say what he felt. This was seconded by Mr. G. E. Anderson, and unanimously carried.

His Excellency proposed that his predecessor, Sir Greame Thomson, K.C.B., be appointed an honorary member of the Board. This was seconded by the Hon. R. E. Brassington and unanimously carried.

The following were reported:—

The Acting Chairman reported that Messrs. G. E. Anderson, the Hon. J. J. da Silva, and Dr. F. T. Wills, who had been granted leave of absence had resumed their seats; also, that Mr. Thos. Earle had been granted three months' leave of absence.

Permission granted Mr. A. R. F. Webber to export two live Curri-Curri (Endocimus rubra).

Permission to collect bird skins granted to Mr. T. A. W. Davis, Assistant Conservator of Forests.

Destruction of Guernsey Bull "Rooseveldt II" through old age.

The affiliation of the undermentioned Associations :—

Berbice Agricultural and Industrial Association.
Beterverwagting & Triumph Farmers' Association.
Buxton & Friendship Farming Association.

The Acting Chairman reported that Mr. R. Ward. Superintendent of the Botanic Gardens, had been granted six months' leave of absence at the expiration of which he would retire after forty years' service in the Department of Agriculture. He proposed that Mr. Ward be appointed an Honorary Member of the Board.

Mr. Britton, in seconding this motion said that Mr. Ward was really the friend of the small farmers to whom he gave practical demonstrations when he went into the country districts. He proposed to return to the Colony so that the Board would continue to have his advice.

Mr. Brassington suggested that a letter be written to Mr. Ward expressing the Board's appreciation of his services. He remarked that there was no doubt that Mr. Ward had rendered very valuable service to the Colony in a very modest way. He was one of those men who hid their light under a bushel, as those who had come into contact with him could not help being struck by his sound practical knowledge of Agriculture.

The motion was put to the vote and unanimously carried.

The change in the dates of the County Agricultural Show, New Amsterdam, Berbice, from the 4th, and 5th, March, 1926, to the 16th, and 17th, September, 1926, was reported.

The following were laid :—

Journal, Board of Agriculture, Volume XVIII.—No. 4.

Journal, Board of Agriculture, Volume XIX.—No. 1.

Letter of thanks received from Lady Hodgson, acknowledging letter of condolence from the Board on the death of her husband.

List of Registered Veterinary Surgeons for 1926.

List of persons authorised to inoculate and to brand animals under Section 32 (2) of the Contagious Diseases (Animals) Ordinance No. 5 of 1920.

Movements and Services of Bulls and Stallions for 1925.

Report on Agriculture Show held at Belfield E.C., on 6.10.25.

Report on Agricultural Show held at Stanleytown, W.B., on 27.10.25.

Report on Agricultural Show held at Mahaicony, E.C., on 25.11.25.

Report on a Farmers' Competition held at Buxton and Freindship, during 1925.

The minutes of the Veterinary Committee meeting held on 24.2.26., dealing with a letter from the Government Veterinary Surgeon as under :—

> " I beg to draw the attention of the Veterinary " Committee to the following : Estates can call " in vaccinators from outside to vaccinate the ani- " mals. Once a place has been proclaimed affected " with disease such as Anthrax, Glanders, etc., the " only one that should be allowed to vaccinate or " test these animals is the Government Veterinary " Surgeon, otherwise, he is not able to control the " disease. I would ask the Veterinary Committee " to make this a very strong point at the Board's " Meeting on the 26th Februray"

was next considered. After some discussion it was decided that the Veterinary Committee should deal with this matter and forward to the Board their decision as to the Amendment required to Section 36 of Ordinance 5 of 1920.

Information required with regard to the possibility of the fruits of "Mango" and "Pithecolobium," in the Colony being prepared as cattle food. This file had

been referred to the Subsidiary Products Committee, which was of opinion that there was not a sufficient quantity of these trees being cultivated in the Colony to warrant further investigation, nor was there any likelihood of there being so in the near future.

An enquiry reproduction of Eddoes in British Guiana and regular shipments to be made to New York, was submitted.

A letter from Messrs. Gore Ltd., Jamaica, *re* a proposed co-operative Fruit Growers and Produce Growers Association was submitted.

Proposed Agricultural Loan Bank.

Mr. Walcott asked what steps were being taken in the matter. The question was brought before the Board twelve months ago, and was in the same position at present. An Agricultural Loan Bank was of urgent necessity and he would like to see some serious action taken in the matter. Mr. Shankland might be brought in and asked to concentrate on such a bank, and his services could be utilised as a whole time officer.

His Excellency said that Mr. Shankland had been appointed on the Committee, and that he hoped that the government would be able to put some definite proposal before the Court of Policy and the Combined Court at an early date.

Allocation of vote XXXVIII. No. 56, Live Stock, purchase of, $1,200 00.

The Government Veterinary Surgeon suggested that the following be imported for 1926:—

Bulls—	2 Short Horn at $360 each	$ 720 00
	2 Freisian at $360 each	720 00
Sheep—	4 Rams H.B. unrelated at $98 each	392 00
	6 Ewes H.B unrelated at $98 each	588 00
Horse—	If required, $1,000 ...	1,000 00
Fowls—	Indian Game $25 per trio	25 00
		$3,445 00

After some discussion it was agreed that the Board should write the Government stating that in their opinion the additional stock mentioned above were required, pointing out that the sum available was $1,200, and asking that they consider the question of obtaining money from the Combined Court.

Mr. Britton suggested that arrangements might be made for the removal of the bulls and stallions from one police station to another at various times, for the benefit of the rural districts.

Mr. da Silva supported the suggestion made by Mr. Britton.

Allocation of vote XXXVIII No. 61, Grants-in-aid of Agricultural Associations, Exhibitions and Competitions for $2,500, as under, was approved of:—

Berbice County Show	...	$ 1,000 00
West Bank Show ...	...	200 00
Mahaicony Show ...	...	200 00
Beterverwagting Show	...	200 00
2 Farmers' Competitions	...	240 00
Affiliation Grants ...	...	160 00
Departmental Expenses	...	500 00
		$ 2,500 00

Questions by the President of the British Guiana Farmers' Conference, and answers to same:—

1. (*Q*) What steps, if any, have been taken or will be taken for eradication of the Congo Bush now growing so very luxuriantly in the Botanic Gardens?

"Congo Bush."

(*A*) Efforts have always been made to kill out the "Congo Bush" by means of continuous lopping in order to weaken the root-stocks which gradually decay. This though being a cheap method was found, however, to be a slow process.

Mr. Ward, Superintendent, Botanic Gardens, therefore took the matter seriously in hand at the begining of this year. The Prison gang in addition to free

labour was put on to push forward the work, and has already cleared the Paddock, the whole of the southern section of the Gardens and also the greater portion of the Park Lands. The last portion of the eastern section of the Park Lands remains to be completed, and is being urged forward.

The method of eradicating this noxious weed is by completely digging out all tillering stumps and root-stocks, and destroying by fire. In some cases the stocks run underground for about 20 to 24 feet. Now that the subject of clearing the Gardens of this pest is well under control, it will be an easy matter to free the Park Lands of any stray shoots that may arise in future.

—(Written by Mr. Abraham.)

2. *Q*. Whether or not any steps have been taken by the Department of Science and Agriculture for the establishment of a Silk Worm Industry; if no such steps have been taken, will the Department now take the necessary steps by the importation of a lot of eggs for purposes of experiment?

A. While on leave in England last year the question of the possibility of establishing a silk industry in this Colony was discussed with the late Professor H. Maxwell Lefroy, who was an authority on sericulture. Professor Lefroy was of the opinion that climatic conditions would be against such an industry in this Colony, although some of the West Indian Islands would be eminently suitable. I also attended a meeting of the Imperial Institute Advisory Silk Committee with the delegates of the Imperial Entomological Conference when the question of silk production within the Empire was discussed. Since my return to the Colony I have gone into the question and am in corresesqondence with the Silk Committee with a view of obtaining a trial parcel of eggs. In the meantime mulberry plants are being propogated.

The raising of silk worms depends primarily upon climatic conditions favourable to the growth of the worms and the mulberrry plant. The mulberry plant

will, however, grow on any soil and in almost all climates. Assuming satisfactory local conditions, the first practical step is to obtain reliable opinion as to the qualities of the cocoons raised locally—their yield of silk and its reeling qualities—and finally a report on the silk obtained—its weaving qualities, etc.

Experience in other parts of the world has shown that sericulture can only be undertaken as a cottage or part-time industry by an industrious and dexterous people. It would be necessary for the women to carry out the rearing of the worms, which in their early stages require constant attention. In India the average family engaged in sericulture makes between $50 and $70 a year at such work. This amount would be considered highly profitable in India. Until the production of cocoons reaches a certain amount it is not a commercial proposition to erect a filature locally for reeling. Until recently this was the stage of the development of the industry even in Cyprus, and it is the stage on which Iraq is now entering. Cocoons from Cyprus are sent to France for reeling, and from Iraq to Calcutta. The freight on cocoons from this country would be high. Although the amount of raw silk entering commerce is roughly 70 million pounds yearly, the greater part of this comes from Japan and China, and the bulk of the remainder from Europe and Asia Minor. The only British countries that produce silk in commercial quantities are India and Cyprus. The United States, although not producing any raw silk, consumes 75 per cent. of the world's crop.

Experiments have been carried out in Jamaica—started in Oct. 1920.

Imperial Institute reported favourably on cocoons in December 1924—and considered that "the trials are "well worth continuing with the object of ascertaining whether, when the necessary sericultural experience "has been acquired, Jamaica is capable of producing "cocoons of good commercial quality."

Jamaica Agriculture Society March 1925 adds "“Our efforts now are being concentrated to secure "enough good cocoons to carry through a reeling test. "According to the Institute this will require 25 pounds, "which is rather a large order for experimenters to pro-"duce."—(*By Mr. L. D Cleare.*)

3. *Q.* Has the Department of Science and Agriculture taken; if not, will it take the necessary steps to ascertain whether or not Black Head Borers are wide-spread in the Rice cultivation of the Colony; and, if so, what remedial measures have been adopted by the Department and recommended to the cultivators of Rice for the extermination of the Borers?

A. Black-headed Borers, that is Diatraea saccharalis F. have been known to occur in rice for a number of years, but it is only recently that they have been reported as doing any appreciable damage in one locality. On several occasions when they have been observed they were attacked by parasites. It is proposed to investigate this question during the coming rice crop, and suitable remedial measures will then be recommended.—(*By Mr. L. D. Cleare.*)

4. *Q.* When last has the Board met at the Botanic Gardens for the purpose of inspecting the plants, live stock, &c.?

(b) Why has so very wholesome a custom been abandoned or suspended?

(c) Will steps be taken for the revival of the practice and a date fixed for such a visit by the Board?

A. On October, 10th. 1913.

5. *Q.* What are the varieties of Mangoes, which in the opinion of Mr. Bartlett when Government Botanist, if carefully picked and unbruised would keep long enough to be exported to England.

(b) Has the Department of Science and Agriculture at any time taken steps to and/or actually recommended to the small farmers the cultivation of such varieties?

A. See "Official Gazette" of 17th June, 1908, F. 1523, which will be published in an early number of the Journal of the Board of Agriculture.

Application for a District Agricultural Show to be held at Beterverwagting and Triumph on 10th August, 1926, was approved of.

APPOINTMENT OF AN INSPECTOR OF AGRICULTURAL PRODUCE.

The following resolution passed by the County of Essequibo Agricultural Association at their General Meeting, held on February 22nd, 1926 was submitted:—

RESOLUTION.

"That the Committee of the County of Essequibo
"Agricultural Association begs to bring before the
"Board of Agriculture what it considers to be a matter
"of supreme importance and urgency, namely, the
"appointment at a date as early as possible, of an
"Inspector or Authority for inspecting and standardis-
"ing all exports of Agricultural produce. It also
"considers that such inspection should be done on the
"wharfs in Georgetown before shipment abroad."

This was referred to the Agricultural Exhibitions Committee of the Board of Agriculture.

Application from Mr. D. D. Haynes for the post of Coconut Inspector.

The Acting Chairman mentioned that an application had been received from Mr. D. D. Haynes, who was taking studies at the Imperial College of Tropical Agriculture, Trinidad, for the post of Coconut Inspector in this colony.

The Hon. R. E. Brassington said that agricultural instructors attached to the Department of Science and Agriculture visited various estates and ordered the destruction of diseased coconut trees and he did not see the necessity—if the Board had the power already—of appointing a new man. He did not want to do anything to hamper agriculture but he thought the machinery was already in existence.

Mr. Britton said that the question of the appointment of a Coconut Inspector arose at a meeting during

Mr. Brassington's absence from the Colony, and the Board decided on the motion of Mr. Strang, to petition Government to place on the Estimate a sum for that purpose. Mr. Haynes happened to be a student from this Colony at the Agricultural College in Trinidad and was taking up studies to suit himself for the position, if appointed. He believed that the amount was put on the estimates on the advice of the Board. If the appointment did not rest with His Excellency, he would move a motion that Mr. Haynes be appointed.

His Excellency said he had been informed that the appointment rested with the Government and there was therefore no need for a motion.

On the motion of the Acting Chairman seconded by the Government Veterinary Surgeon, the undernoted Orders under Section 23 of the Improvement of Breed and Prevention of Contagious Diseases (Animals) Ordinance, 1920 were unanimously confirmed:—

Date of Order.	Area Declared.	Disease
18th January, 1926.	At Pln. Providence, East Bank, Demerara, bounded on the North by the side-line opposite Head Overseer's house, on the South by No. 3 Canal, on the East by the Public Road, and on the West by the Demerara River.	Anthrax.
5th February, 1926.	At Pln. Providence, East Bank, Demerara, bounded on the North by Eccles side-line on the South by No. 3 Canal, on the East by the Lamaha Canal, and on the West by the Public Road, Providence North side-line and 84 X Dam.	Anthrax.
5th February, 1926.	At Pln. Tuschen, West Coast, Demerara, bounded on the North by the Atlantic Ocean on the South by the Railway line, on East by Zeelught side-line, and on the West by Tuschen side-line. At Pln. Tuschen,	Anthrax.

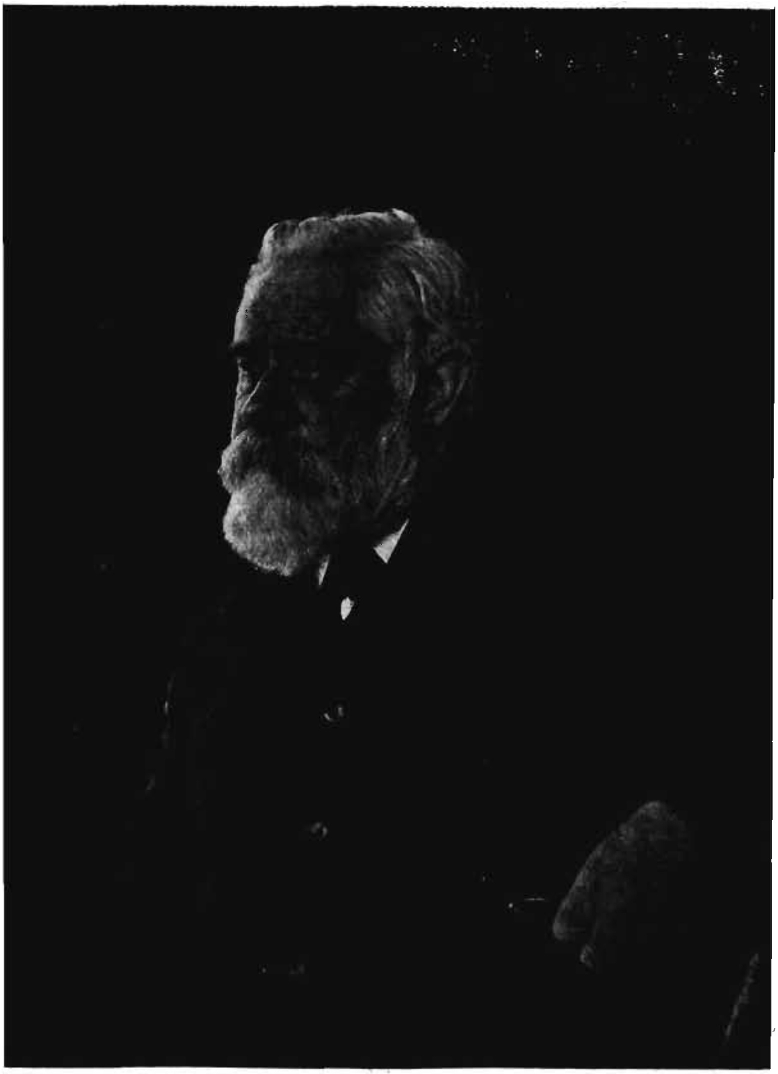
Date of Order.	Area Declared.	Disease.
5th February, 1926.	At Pln. Tuschen, West Coast, Demerara, bounded on the North by the south trench running alongside the public road, on the South by the Boerasiri Canal, on *the East by Tuschen east side-line* and on the West by Tuschen west side-line.	Anthrax.

Brand to be used on all animals inoculated against Anthrax.

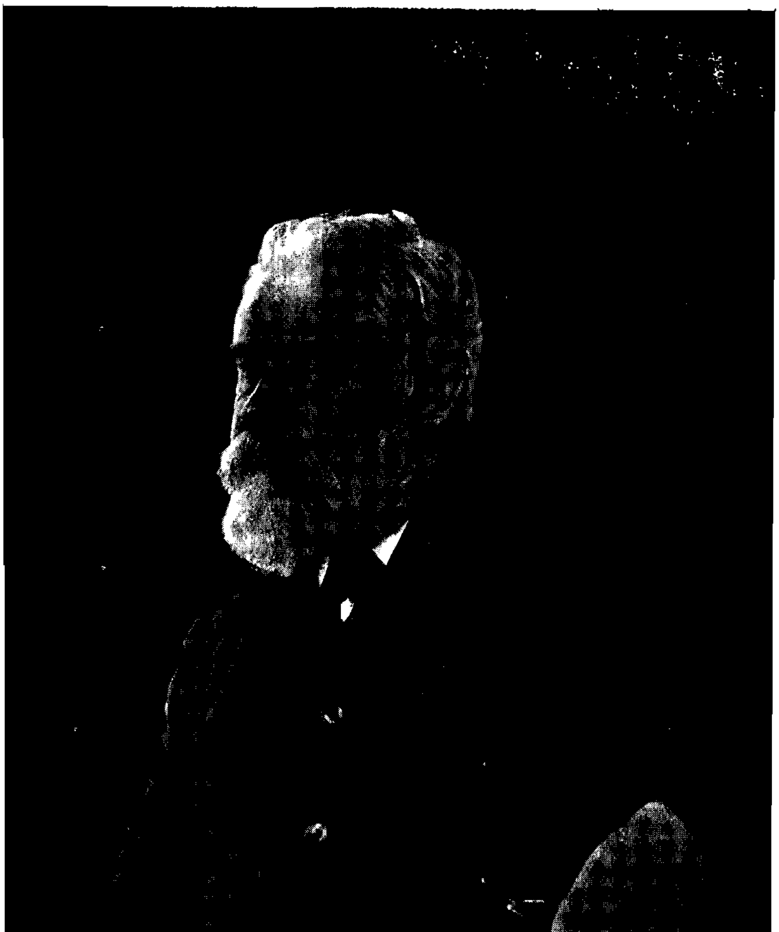
On the motion of the Acting Chairman seconded by the Government Veterinary Surgeon the above Orders under Section 23 of the Improvement of Breed and Prevention of Contagious Diseases (Animals) Ordinance, 1920 were unanimously revoked.

Order No. 543, dated 24th June, 1925, published in the "Official Gazette" of 27th June, 1925, exempting race horses from examination by the Government Veterinary Surgeon, was revoked.

The Chairman then adjourned the meeting to a date in May to be fixed later.



J. B. Harrison



J. B. Harrison

OBITUARY.

SIR JOHN BURCHMORE HARRISON, C.M.G., M.A., F.I.C., F.G.S., ETC.

Born 29th May, 1856—Died 8th February, 1926.

It is with extreme regret that we have to record the death of Sir John Burchmore Harrison, C.M.G., Director of Science and Agriculture and Chairman of the Board of Agriculture, which took place at the Public Hospital, Georgetown, on the 8th February, 1926.

Sir John Burchmore Harrison was born near Birmingham, Warwickshire, on 29th May, 1856. He was the son of John Harrison, a cotton merchant, and Anne Burchmore of Lincoln.

He studied Chemistry at the Edgbaston School under the late Dr. G. Gore, F.R.S., and Mr. C. J. Woodward, B.S., and in 1871 at the age of 15, sat the Oxford Local Examinations being placed third in the 1st class of the Natural Science Section, his subjects being Chemistry and Physics. He also studied Geology and Mineralogy, under the late Revd. Dr. George Deane of the Midland Institute, and in March, 1874, was awarded an open Scholarship in Natural Science at Christ's College, Cambridge, his subjects being Chemistry, Physics, Geology and Mineralogy. In May, 1874, he was placed First in the 1st class of the Natural Science Division of the Oxford Senior Local Examinations, his subjects being Chemistry, Physics, Geology and Mineralogy specialising in Analytical Chemistry; and in the same month received a 1st class in Honours at the Science and Art Department Examination again specialising in Chemical Analysis. He was awarded the Queen's Medal for that year in Geology and Mineralogy and was also awarded a special Scholarship in Science from the Edgbaston School.

He was reading Chemistry, Physics, Geology and Mineralogy at Cambridge from October 1874 to 1877 when he passed Part I of the Natural Science Honours in June of the latter year. In January, 1878, he completed his degree in Part II of the Natural Science Tripos, specialising in Chemistry with stress on Analytical Chemistry. Among his contemporaries were Professor Bower of Glasgow, the eminent Chemist Fenton of Christ's, and Adam Sedgwick of Trinity. Until December of that year he was at Cambridge University, pursuing a post-graduate course in Analytical Chemistry and assisting the late W. J. Sell, D.Sc., F.R.S., formerly University Demonstrator in Organic Chemistry, in specialised Analytical Research. From January to July, 1879, he was Lecturer on Chemistry at Berkhamsted School. In April of that year he was appointed to the newly created post of Island Professor of Chemistry and Agricultural Science at Barbados, B.W.I., by the late Professors Sir James Dewar and Dr. Liveing of the Cambridge University Laboratories. In July to September, 1879, he resumed his post-graduate studies in the Cambridge University Laboratories, and at Rothamsted Experimental Station, under the guidance of Sir John B. Lawes and Dr. Gilbert, specially devoted himself to Agricultural Chemistry. He took up his post in Barbados in September of that year. On September 19th, 1925, he received a letter from Sir Daniel Morris congratulating him on the record he had made for length of time, etc., in active scientific research work in the British West Indies and British Guiana. We may mention that from 1872 to 1879, he was an active member of the Birmingham Natural History Society being the Secretary of its Geological section; this supplied him with many opportunities of examining coal, ironstone and limestone mines in the South Stafford Coal District as well as lead and other metalliferous mines in North Wales.

Prior to his coming to this Colony in 1899 as Gov-

ernment Analyst and Professor of Chemistry, Professor Harrison as he was then known, was already recognized in Barbados and the other West India Islands as a scientist of repute. The results accruing from his pioneer work in conjunction with that of Mr. J. R. Bovell on the raising of new varieties of sugar cane from seed have been of incalculable value to the Sugar Industry of the world. His training at the Rothamsted Experiment Station bore early fruit by the inauguration in 1886 of the Manurial Experiment with Sugar Cane at Dodds, Barbados. These and similar experiments conducted by Sir John in the Botanic Gardens here, soon established him as an authority on the manurial requirements of the sugar cane. The value of these experiments was greatly enhanced by the degree of accuracy with which the analysis of the various soils, manures and sugar-cane products was carried out. It was here that Sir John Harrison's knowledge and skill as an analyst was most prominent, the majority of these analysis being performed by himself, as his laboratory note-books show.

In 1905, in addition to the posts of Government Analyst and Geologist, on the organization of the Department of Science and Agriculture, Sir John was appointed to be its Director. Two years later he was instrumental in causing this *Journal* to be started.

Sir John was for many years an active member of the Royal Agricultural and Commercial Society of British Guiana, being a Director at the time of his death. He was President of that Institution in 1897 and again in 1918 after a lapse of 21 years. He was a member of the Board of Agriculture from its inception in 1901 and was present at all the meetings of the Board, save when he was absent from the Colony. Sir John was also a member of the Executive Council of British Guiana from 1918 until his death, and of numerous boards and committees during his long period of service.

A most important achievement was the establishment in 1919 of the B. G. Sugar Planters Experiment Stations. It was largely if not entirely due to Sir John's influence that the Sugar Planters of the Colony co-operated in this scheme which had been in their minds for over thirty years. No higher tribute could have been paid to Sir John Harrison than this successful co-operation of the planters to extend under his direction the sugar-cane experiments started by him in the Botanic Gardens.

In 1901, Sir John was rewarded for his services with the C.M.G., and in 1921 he received the Honour of Knighthood. In 1887 while in Barbados, Sir John was elected a Fellow of the Institute of Chemistry on account of his professional standing. Later he was elected a Fellow of the Geological and Chemical Societies of London and of America, and of several other similar associations in England and the U.S.A.

It is not within the scope of this notice to deal with Sir John's multifarious activities in the realms of scientific research. It is sufficient to say that Geology and Microscopy were to him a form of recreation, and his travels in the British West Indies and the interior of British Guiana in connection with Geological enquiries must have been to him a labour of love.

By Sir John Harrison's death the Board has lost its oldest and most valued member, the Department of Science and Agriculture, a father and wise administrator, and British Guiana its most distinguished and self-sacrificing colonist.

Sir John Harrison was married in 1881 to Hortense, daughter of Mr. J. P. Carter of Barbados, by whom he had one daughter now wife of Mr. H. A. Frere of Roydon Hall, Diss, Norfolk, and one son who died in 1922 whilst Medical Officer of Singapore. To Lady Harrison and family, the *Journal* expresses its deep sympathy.

OBITUARY.

ALFRED SETON MILNE M.R.C.V.S., F.E.V.M.S. ETC.

Born 26th April 1874—Died 11th March, 1926.

We regret to have to record the death of Mr. Alfred Seton Milne, which sad event took place somewhat suddenly at his residence, 68 Croal Street, Georgetown, on the 11th March, 1926.

Mr. Milne was born at Ladykirk, Scotland, on the 26th April, 1874. He was educated at Geo. Watson's College, Edinburgh, and graduated M.R.C.V.S. in 1894 at the early age of 20. He commenced to practice in his profession with Mr. Storey in East Linton and afterwards set up in independent practice at Berwick-on-Tweed. He came to the Colony in 1904 when he was appointed Municipal Veterinary Surgeon. During the following years Mr. Milne identified himself with matters pertaining to his profession; he also became a devoted racing enthusiast, and the owner of a fine string of animals. Extending his studies, Mr. Milne obtained while on a visit to his home country the further diploma of F.E.V.M.S., and on July 1st 1914, on the retirement of Mr. J. A. Raleigh, he was appointed to the post of Government Veterinary Surgeon.

Being full of energy, Mr. Milne devoted himself whole-heartedly to his work. He became a member of the Board of Agriculture 1921, and as a member of several sub-committees of the Board his advice on matters veterinarian was much sought after. In addition to his Municipal and Government appointment the deceased had an extensive and lucrative private practice.

Mr. Milne was exceedingly popular throughout the Colony and in addition to being an enthusiastic oarsman, took a keen interest in cricket and other sports and in later years became a keen golfer.

In 1905 Mr. Milne married in Georgetown, Miss Morton of Seton Delaval. He leaves a widow, an aged father, two brothers and a sister to mourn his untimely death; to all of whom we tender our deep sympathy in their sad bereavement.

REPORT ON THE SECOND IMPERIAL ENTOMOLOGICAL CONFERENCE HELD IN LONDON IN JUNE 1926, AND VISIT OF COLONIAL AGRICULTURAL OFFICERS TO ROTHAMSTED EXPERIMENT STATION.

By L. D. Cleare, Jr. F.E.S., F.L.S. Government Economic Biologist, British Guiana Delegate.

I.—The Second Imperial Entomological Conference.

The Conference, which commenced on Tuesday, June 9th and lasted until Thursday, June 18th was opened by the Right Honourable Earl Buxton, Chairman of the Managing Committee of the Imperial Bureau of Entomology. In addition to many of the most prominent entomologists of Great Britain, there were present twenty-two delegates from the Dominions and Colonies representing the Governments of the Union of South Africa and Southern Rhodesia, the Commonwealth of Australia, Western Australia, Canada, Ceylon, Egypt, Gold Coast, India, Irish Free State, Northern Ireland, Kenya, New Zealand, Nigeria, Northern Rhodesia, Sierra Leone, the Straits Settlement and the Federated Malay States, Sudan, Tanganyika Territory, Tasmania, Trinidad and Uganda.

After receiving the delegates Lord Buxton addressed the Conference and first referred to the loss sustained by the Bureau through the death of Viscount Harcourt, who had taken such a great personal interest in the work of the Bureau.

Lord Buxton said that the previous Conference held in 1920 had recommended that the Bureau should be in possession of an income of £13,000 a year, and he was pleased to think that that sum, as the minimum

revenue of the Bureau was now in sight. If, at the same time, increased funds are forthcoming the operations of the Bureau could be extended, and he mentioned the very large sum amounting to about half a million sterling that was at the disposal of the United States Bureau of Entomology.

He cited figures from a memorandum which had been prepared by the Director on the work of the Bureau from April, 1920, to March, 1925, to show the increase in the work of the Bureau that had taken place since the last Conference, The most striking of these was the increase that had taken place in the identification of insects. In 1920-21 the number of collections received and examined numbered 187 and contained some 29,800 specimens while in 1924-25 the collections received numbered 347 and contained over 63,676 specimens. When the present position in regard to entomological problems was considered it was clear that the reasons which led to the formation of the Bureau in 1913 were now more powerful than ever, and the absolute necessity of some central body that could act as a "clearing house" with regard to entomological matters was becoming more and more evident.

The opening meeting of the Conference was the Business Meeting which was devoted to the consideration of the work and finances of the Imperial Bureau of Entomology. A memorandum on the work of the Bureau from 1st April, 1920, to 31st March, 1925, was circulated amongst the Delegates and Dr. G. A. K. Marshall, the Director of the Bureau, in referring to the memorandum gave an account of the origin and early history of the Bureau.

In addition to the figures above with regard to the identification of insects the memorandum dealt with the oth f the Bureau amongst whic ssued by the Bureau, namel l Entomology

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and the Bulletin of Entomological Research. The *Review of Applied Entomology* is a publication in which is collected abstracts of all papers on economic entomology throughout the world, and deals with both insects injurious to plants as well as those harmful to man and domestic animals. The preparation of this publication is probably the most important duty of the Bureau and involved a vast amount of work, and during the last quinquenial period the number of articles abstracted averaged 2,309 annually. The review, which is now in its thirteenth year, has become an essential publication to every worker in economic entomology. The *Bulletin of Entomological Research* on the other hand deals mainly with the more technical and taxonomic aspect of the subject, and publishes papers which are not suitable for the local publications of the various Departments of Agriculture. Copies of both these publications are received free of charge from the Bureau by this Division, while the Division has been accorded the publication on several papers through the courtesy of the Bureau since its inception.

Another important duty recently assumed by the Bureau is the preparation and publication of the Insecta part of the Zoological Record. Without the Zoological Record it would be almost impossible to keep in touch with the vast literature on systematic entomology, and the identification of insects would soon be in a chaotic state.

Another line of work upon which the Bureau has recently embarked is the export of beneficial parasites. The position of the Bureau in this respect should be defined unless some misunderstanding occur in this colony on the work. This line of work was the outcome of a request from Dr. R. J. Tillyard from New Zealand who some two years ago wrote asking "whether it would not be possible for the Bureau to make arrangements to supply useful European parasites that might be needed in various parts of the Empire...... he mentioned that

he was particularly anxious to obtain parasites of the European earwig, which was increasing to a serious extent in parts of New Zealand."

Special consideration was given to this question and "it was felt that the Bureau could do valuable work in this direction on behalf of certain of the Overseas Governments, but that it might be necessary in certain cases to ask for a special grant from the Government concerned if the supply of a particular parasite should involve costly investigations." The Conference approved of the estimate of £1,440 ($6,912) annually for this work.

During the Conference visits were paid to the Universities of Oxford and Cambridge, to the Rothamsted Experiment Station at Harpenden, to the Pathological Laboratory of the Ministry of Agriculture, and to the British Museum (Natural History), while meetings of the Imperial Institute Advisory Committee on Silk Production, the Zoological Society and the Linnean Society were attended.

Papers on various aspects of economic entomology were read by several of the delegates during the Conference, and short summaries of some of these will be given here.

(1) "Migration as a factor in Pest Outbreaks" was the subject of a paper by Mr. T. Bainbrigge Fletcher, Imperial Entomologist of of India. Mr. Fletcher said that while fluctutations of insect abundance in regions could frequently be ascribed to factors such as parasitic control or climate, it sometimes happened that outbreaks of insects occurred that could not be the result of abnormal local breeding and must be attributed to migrations from other localities. In India they found an accumulation of cases for which such an explanation seemed the only one possible.

(2) Mr. A. Gibson, Dominion Entomologist of Canada, read a paper on "Entomological Organisation in Canada" and gave a general account of the organisation of the Entomological Branch of the Department of Agriculture of the Dominion of Canada. The organisation is now comprised of five Divisions, namely, Administrative, Field Crops and Garden Insects, Forest Insects, Foreign Pests Suppression, and Systematic Entomology. An important feature of the Branch was the establishment of permanent research laboratories in the several provinces. The Canadian organisation was modelled on that of Washington. With regard to the Canadian budget for entomological services he explained that the money was spent on research and not on the actual carrying out of control measures. A number of lantern slides were shown illustrating various types of laboratories, insectaries, etc., as well as control work against pests causing serious damage.

COTTON.

(3) Mr. H. H. King, Government Entomologist to the Sudan Government, read a paper on "Methods of dealing with Cotton Pests in the Sudan." He gave an account of the measures which the Sudan Government had drawn up with regard to the cotton pests in that country.

(4) Mr. A. W. J. Pomeroy, Government Entomologist, Nigeria, read a paper on "Cotton Pests in Nigeria, with a preliminary discussion of the Status of Economic Entomologists in Government Service" which was followed by a discussion by several delegates.

SILK.

(5) The delegates of the Imperial Entomological Conference attended a meeting of the

Imperial Institute Advisory Committee on Silk Production on the 11th June.

Sir Frank Warner, who presided at this meeting, referred to the position of the world's silk trade and pointed out that the total quantity of raw silk entering commerce was about 70,000,000 lb a year. By far the greater part of this production came from Japan and China, and the bulk of the remainder from Europe and Asia Minor. Supplies within the Empire were negligible and only two British Colonies produced silk in commercial quantities, namely, India and Cyprus. There is a steadily increasing demand for raw silk by manufacturers, especially in the United States, which country consumes about 75 per cent. of the world's crop although not producing any raw silk itself. The production of silk was not keeping abreast of the increasing demand.

Professor Lefroy pointed out that there were other conditions besides suitable climatic conditions and an abundance of the mulberry plant that must be taken into consideration in the starting of a silk industry in any particular country. The abundance of cheap labour was an important factor, and until the cocoons could be reeled locally the heavy freight charges that would have to be paid on the cocoons was also important.

(6) Among the papers read and discussed at the conference were "The Aims and Organisation of Economic Entomology" by Dr. G. A. K. Marshall, Director of the Imperial Bureau of Entomology, and "Entomological Organisation in Egypt," by Mr. C. B. Williams, Entomologist to the Egyptian Government.

(*a*) Dr. Marshall's paper was of especial interest in that he brought out several points bearing upon the duties of Government Entomologists, and the function of departments under their control. He pointed out that "The concentration of entomological work in "the hands of a comparatively small Gov-"ernment department had undoubted ad-"vantages in the early stages of a country, "but it also presented some undesirable fea-"tures. In the first place it tended to create "in the minds of the farmers and planters the "idea that an entomologist is merely a person "who can be called in to assist in coping with "insects when they have become so numer-"ous as to cause serious damage to their "crops; in other words that the functions of "the entomologist are merely curative. The "idea was radically unsound."

These observations apply very much to British Guiana, but one may add that the entomologist is here invariably called in when the pest has become uncontrollable, and even then if the position is not too hopeless for him to suggest measures of control and he advises a treatment, little or no attempt is made to carry it out.

Dr. Marshall went on to say that "The most "important function of the Government En-"tomologist was research, but the cost of the "application to any given crop of the know-"ledge thus acquired should fall on the "growers themselves; and if it was found "necessary that the work should be done by "official entomologists then it should be "charged for, and in this way an efficient "self-supporting service might gradually be "built up."

(b) Mr. C. B. Williams, in his paper "Organisation of Entomology in Egypt" gave details of the present organisation of the Entomological Section of the Ministry of Agriculture of Egypt. The section, which was started in 1911, has developed into a very large organisation and is divided into two main sections, Research and Administrative. It not only investigates and advises on the control of pests, but also carries out for itself control measures that in most other countries are done by private individuals or companies. The total annual expenditure on the section is nearly £100,000, but of this about £40,000 is recovered in fees for the fumigation of citrus trees to kill scale insects.

At the final meeting of the conference held on the 18th June, the following resolutions were unanimously adopted :—

(1) The Conference wish to place on record their appreciation of the work of the Imperial Bureau of Entomology.

(2) The Conference, recognising the value of the interchange of ideas between entomologists from all parts of the Empire, endorse the resolution passed at the Conference held in June, 1920, that similar Conferences should be held in London every five years, and trust that steps may be taken for the summoning of the 3rd Imperial Entomological Conference in the summer of 1930.

(3) The Conference recommend that from time to time, as circumstances may render practicable, meetings should be held in each of the Dominions and Colonies of the entomologists, mycologists, and other scientific officers for joint discussion of their problems, and that

this principle should be extended to include meetings at some convenient central place of Dominion and Colonial entomologists, mycologists, and other scientific officers who are working in countries which are associated geographically or otherwise.

(4) Having regard to the ever-growing importance of economic entomology, the Conference urge that the fullest consideration should be given throughout the Empire to the provision of funds to allow of such expansion of the work of the official entomologists as may be found desirable.

At the same time they strongly support the view that large planting companies, or groups of planters and farmers, should, in their own interest, follow the practice already adopted in certain instances with satisfactory results, of engaging the permanent services of entomologists who can keep watch over the crops on the plantations or farms concerned with a view to their protection against insect pests.

(5) The Conference recommend that the annual revenue of the Bureau for the period 1926 to 1930 inclusive should be not less than £13,000.

(6) The Conference recommend that contributions amounting to approximately £11,600 per annum from the Imperial Government, the Dominions, self-governing Colonies, and Colonies not possessing responsible government should be continued at the same rates as for the current financial year, subject to such adjustment between the contributions paid by Colonies not possessing responsible Government as the Secretary of State for the Colonies may think desirable.

(7) The Conference are glad to learn that the Government of India has decided to make a contribution of £300 to the Bureau for the current financial year; but having regard to amounts contributed by other Governments and in view of the value of the Bureau to India, they express the hope that India as a whole will see its way to contribute at the rate of £1,000 per annum from 1926 inclusive, that being the amount contemplated when the rates of contribution from other Governments were fixed after the Conference held in 1920.

(8) The Conference express their satisfaction that official representatives of the Governments of the Irish Free State and of Northern Ireland have taken part in their deliberations, and they hope that these two Governments will in future contribute to the Bureau.

(9) The Conference approve the estimate of average annual expenditure on normal services for the period 1926 to 1930 inclusive, as presented in the report of the Director of the Bureau, amounting to £12,200 on the assumption that the necessary funds will be available.

(10) The Conference accept the principle that the Bureau should arrange for the export to Overseas Governments of beneficial parasites and they approve the estimate of £1,440 per annum for this work, as presented in the report of the Director of the Bureau, making an estimated average annual expenditure of £13,640 in all.

It is understood that if the annual contributions amount to £13,000 the annual expenditure in excess of that sum can be met for the

next five years from the surplus funds which the Bureau has accumulated ; but should the Bureau be requested to undertake the supply of a parasite which involves investigations of a costly nature it should be open to the Director to represent to the Government concerned that the work cannot be undertaken without an additional grant for the purpose.

(11) While leaving the matter to the discretion of Managing Commitete of the Bureau the Conference consider that in present circumstances it would be inadvisable to increase the price of the publications issued by the Bureau.

(12) The Conference approve the arrangements made by the Director of the Bureau for the preparation and publication of the "Insecta" portion of the "Zoological Record" and recommend that this should be continued.

(13) The Conference do not recommend that steps should be taken to prepare a new edition of the Abstract of Plant Pest Legislation in the Empire, but they are of opinion that abstracts of the new legislation on this subject should be published as hitherto in the "Review of Applied Entomology."

(14) The Conference consider that the preparation of a comprehensive index to Series A of the "Review of Applied Entomology" is desirable, but regret that for financial reasons it does not appear to be practicable to proceed with the preparation at the present time. The Conference hope, however, that it will eventually be found possible to undertake this work.

(15) The Conference recommend that at the end of each financial year all the contribut-

ing Governments should receive a statement showing the work accomplished by the Bureau during the year.

(16) While recognising that in existing circumstances and with the funds at present at the disposal of the Bureau such a proposal may not be practicable, the Conference record the opinion that it would be of the greatest assistance if arrangements could be made for a Senior Officer of the Bureau to visit at request the Government Entomologists overseas.

(17) The Conference are glad to learn that proposals have been made for the despatch of an International Scientific Mission to Uganda, under the direction of Dr. H. Lyndhurst Duke, for further research in connection with testse-flies and human trypanosomiasis, but they strongly urge that arrangements should be made for comprehensive mearures against testse (both in the direction of immediate practical work and further scientific research) in the British dependencies in Tropical Africa on the lines contemplated in the Report of the East Africa Commission.

(18) The Conference, whilst gratefully acknowledging the invariably courteous and ready assistance afforded to entomologists by the Entomological Staff of the British Museum (Natural History), desire to draw the attention of the Trustees of the Museum to the paucity of the staff employed at the Museum on this subject, and also to the scanty accommodation, due to the present overcrowding state of the Insect Room, available for entomologists who wish to work at the Museum. In view of the vast and constantly increasing importance to the Empire

of a thorough knowledge of insects which occur both in the British Empire and in foreign countries, and to the vital necessity for the proper progress of work in Applied Entomology, of a corresponding progress in Systematic Entomology, the Conference desire to urge on the Trustees the necessity for an increase in the permanent staff employed in the Entomological Department of the Museum and in the accommodation available therein.

(19) The Delegates to this Conference desire to record their sincere thanks to the Chairman, Earl Buxton, to the Honorary Committee of Management, the Director and the Assistant Director of the Bureau for the excellent programme which they have provided for the Conference, and also to Sir Arthur Shipley, Professor Stanley Gardiner and Dr. Hugh Scott, of Cambridge University, to Professor Poulton and Dr. Dixey, of Oxford University, to Sir John Russell, Dr. Davidson, and the other members of the staff of the Rothamsted Experimental Station, and to Mr. J. C. Fryer and his colleagues at the Pathological Laboratory of the Ministry of Agriculture, for the instructive visits which they arranged.

II.—Visits to Rothamsted Experiment Station.

Rothamsted Experiment Station was visited on two occasions, first with the delegates of the Imperial Entomological Conference, and again with the Colonial Agricultural Officers. On both occasions both the field plots and laboratories were visited.

The parties were conducted around several of the field plots, and the work in progress explained. Perhaps the most interesting of these was the well-known Broad Walk Field,

This field was among the original fields laid out by Lawes and Gilbert in 1843, and has since that time been continuously under wheat. The application of different manures on this land has been studied now for a number of years, and the data thus obtained has proved highly interesting and important.

In the course of the explanation a point brought out that may be of interest locally, is the possible substitution of muriate of ammonia (Ammonium chloride) for sulphate of ammonia as an artificial manure. There appears to be little or no difference in the action of these two substances in places where the rainfall is high, while price is in favour of the ammonium chloride.

The experience at Rothamsted is that muriate of ammonia is less effective than the sulphate for potatoes, but more effective for barley. The difference becomes less as the rainfall increases.

In the laboratories the investigations on insecticides being carried out by Mr. Tattersfield, on aphids by Dr. Davidson, and on soil insects by Mr. Morris, were explained by the workers themselves, as well as Dr. Keen's investigations with regard to the draw bar pull on ploughs, and Dr. Hutchinson's work on artificial farmyard manure.

Dr. Hutchinson was at the time carrying out investigations into the possibility of using the trash of sugar-cane for artificial manure, and this question was discussed with him.

The production of manure direct from straw is now being carried out on a large scale in England, and it is estimated that some 3,000 tons of straw and like material was treated in Great

Britain during the last season. The making of artificial farmyard manure is based on the fact that the organisms which produce the changes are naturally present either in the straw or in the dust, and only need suitable conditions to bring about the changes. These conditions are brought about by the addition of certain, easily obtained substances, especially nitrogen compounds, phosphates and calcium carbonate. Decomposition then rapidly takes place, converting the waste straw to valuable manure.

When one recollects the large amount of trash of the sugar cane and rice straw that are from year to year burnt in this Colony, it would appear to be a project well worth investigating.

Among the other interesting and important work that is being carried out at Rothamsted mention should be made of the work of the Statistical Department under Mr. R. A. Fisher. At the present time at Rothamsted wherever it is possible all field and laboratory observations are subject to the scrutiny of the Statistical Department with the view of obtaining as great as possible accuracy of results, and field data are examined in order to trace correlations between weather's crop growth, and other quantities measured. In order to do this it has been necessary to develop statistical methods to meet the particular work. The result of such examination has been the introduction of improvements in methods of experimentation, and at the present time a far higher degree of accuracy is obtained than was formerly the case.

In conclusion I would point out that the practical results of conferences such as these to workers in science, more or less isolated from the

important centres of research as one is in this colony, are manifold, and perhaps can best be summarised in the following words from the letter of the Right Honourable Earl Buxton, Chairman of the Second Imperial Entomological Conference, to the Right Honourable L. S. Amery, Secretary of State for the Colonies, submitting the report of the Conference:— "The whole benefit to be derived from a "Conference of this nature is by no means "reflected in the Report of its proceedings. "Nothing is of greater value to men working "at the same subject under varying conditions "than that they should be able to meet one "another and discuss informally the problems "with which they are dealing; and these "Conferences furnish an unequal opportunity "for establishing personal touch of this kind."

THE CLIMATE OF BRITISH GUIANA.

ABSTRACT OF OBSERVATIONS—1846-1925.

By Sir John Harrison, C.M.G., late Director of Science and Agriculture.

As would be expected from the geographical position of British Guiana, the climate is warm, but on the whole a very healthy one. The usual range of temperature each year is from 65° to 91°. There is a long dry season from the middle of August to near the end of November, and a shorter, less sharply defined one in February, March and part of April; the remaining two periods are termed the short and long wet seasons respectively. But the long dry season is the only one of these that is sharply marked in every year, the short dry season not unfrequently turning out a very wet one, the short wet season is at times a period of more or less well-marked drought, while the long wet season may be of short duration.

For very many years, commencing in 1846 systematic meteorological observations have been made in Georgetown; the climatological records from 1882 onwards being very complete. A sub-station has been at work at the Penal Settlement, Mazaruni River, for over a quarter of a century. Observations of the more important climatological elements were taken for relatively short periods at two stations—Dada-nawa and at Eupukari on the Rupununi river savannah district.

Sir Robert Schomburgk, during his very extensive travels in the interior of the Colony between 1836 and 1843, made many observations at numerous places in the far interior, but, as he was constantly travelling, none of these covered any length of time.

The following abstracts of the observations at Georgetown are of interest:—

Meridian of longitude for calculation of time adopted as standard in the Colony	...	60° W.
Hours slow of Greenwich time	...	3° 45.

The meteorological station is situated in the Botanic Gardens, at a distance of 1.45 miles south of the coast-line. The hours of observation are 7 a.m., and 1 and 6 p.m., local official time which is 3 hours and 45 minutes behind Greenwich time. The height of the cistern of the barometer is 6 feet 6 inches above the mean sea-level.

Temperature.—During the period 1846 to 1925 the mean temperature in the shade was 80.4° Fahr., the mean of the maximum temperature being 84.7°, and the mean of the minimum temperature 75°. The absolute maximum temperature recorded during the period was 92°, the minimum 68°; it is, however, a very rare occurrence for the maximum temperature in the shade to rise above 89°, or for the minimum to fall below 70°. The highest mean monthly temperature recorded in the shade was 89.3° in October, 1915, the lowest being 69.2° in September, 1850. The maximum sunshine radiation temperature (black bulb in vacuo) recorded on any day was 165°, whilst the minimum radiation temperature at night on grass was 60°, the highest mean monthly maximum being 152°, while the lowest mean monthly was 129.8°. The effect of the sunshine in raising the temperature of the earth is apparent to a depth of somewhat over 4 feet from the surface, at this depth the minimum monthly temperature during the year is 83°, whilst the maximum is 85°. The mean temperature of the earth from a depth of about 20 feet to 160 feet is 83° Fahr., below which depth the temperature slowly increases at the rate of approximately 1° Fahr. for each 90 feet increase in depth.

Rainfall of the Coastlands.—Fairly complete records of the rainfall of the lowlands of the colony exist from the year 1846 to the year 1925, with the exception of the period September, 1857, to March, 1863, the records of which have been lost or destroyed. The following are the average monthly records showing in addition the highest and the lowest rainfall recorded for each month with the year in which they occurred;—

Months	Rainfall.	Maximum Records.	Years.	Minimum Records.	Years.
January	7.82	20.77	1870	1.27	1901
February	5.54	16.55	1887	.55	1919
March	6.30	20.04	1907	.21	1873
April	6.71	20.59	1865	1.08	1867
May	12.58	22.23	1919	.40	1873
June	11.94	20.44	1849	1.87	1874
July	9.21	23.60	1863	2.47	1880
August	6.78	13.94	1857	1.78	1868
September	2.82	8.47	1876	.46	1888
October	2.68	9.99	1921	.03	1854
November	5.73	17.80	1897	.36	1884
December	11.43	26.16	1891	1.77	1881
Average Annual Rainfall ...	89.54	132.58	1893	44.93	1868

Rainfall of Georgetown.—During the 45 years period from 1880 to 1925 the rainfall at the Botanic Gardens, Georgetown, was 89 inches a year, the driest year being 1889 with a rainfall of 52.70 inches, and the wettest 1893 when the rainfall amounted to 135.24 inches. The average monthly rainfalls with the maximum and minimum rainfall recorded in any one month were as follows :—

Although the climate of Georgetown in common with that of the coastlands of British Guiana is regarded as a very wet one, excessively heavy rainfalls, such as are regarded as typical tropical rainfalls, are of somewhat rare occurrence. While the amount of rain which fall in each month of the year is subject to very great variations, the number of days of exceptionally heavy rainfall—over 5 inches falling in 24 hours—are very few. There have been only thirteen instances of rainfalls in excess of 5 inches in 24 hours during the long period 1880 to 1924, whilst the number of days in this period in which rainfalls have been in excess of 2 inches are shown in the following :—

Rainfall in 24 hours.		No of days in 45 years.	Approximate No· of days in 10 years·
Over 2 and under 3 ins.	...	205	45
„ 3 „ „ 4 „	...	71	16
„ 4 „ „ 5 „	...	16	4
Over 5 ins.	...	15	3

Ten of the rainfalls in excess of 5 inches in 24 hours were between 5 and 6 inches in quantity, 2 of them were between 6 and 7 inches, whilst one was somewhat in excess of 8 inches.

The climate of the coastlands of the county of Demerara may be regarded as characteristic of the whole coastlands of British Guiana, with the exception that the average annual rainfall in the eastern section of the coastlands is less than that of the middle or Demerara section, which in turn is less than that of the western or Essequibo section. The average annual rainfalls from 1880 to 1924 in these sections were as follows :—

with the exception of the month of June in which variations in the rainfall have ranged in the county of Demerara from 4.4 inches to 46.88 inches.

The frequencies of the rainfall in Georgetown are shown by our records from 1846 to 1921 to have been as follows:—

			Per Year.
Total rainy days	...	...	196
Under .10 inch	...	...	60
.10 to .50 inch	...	...	80
.50 to .1 inch	...	...	29
1 to 2 inches	...	...	20
Above 2 inches	...	...	7

The average yearly evaporation from a 6 feet square free water surface during the period of 10 years 1915 to 1925 was 58 inches, or approximately 65 per cent. of the total rainfall.

Velocity of the Wind.—The average velocity of the wind at an altitude of 60 feet above the ground is 7.16 miles per hour, the highest velocity noticed during the past 10 years having been 20 miles per hour during a two hour period, but at times, although not frequently, sudden gusts of wind occur with velocities somewhat in excess of 25 miles per hour. The prevailing direction of the wind is about N. 50° E.

Bright Sunshine.—During the past 35 years the average annual number of hours of bright sunshine as indicated by a Campbell-Stokes' Recorder has been 2443, cr approximately 6 hours 41 minutes per diem. The distribution of the daily hours of bright sunshine during the various months of the year were as follows:

	Mean.	Maximum.	Minimum.
January	6.0	8.5	3.9
February	6.8	10.0	3.7
March	6.5	9.5	3.3
April	6.6	9.7	4.2
May	6.3	9.5	2.9
June	5.8	8.0	2.4
July	7.1	9.0	4.2

	Mean.	Maximum.	Minimum.
August	7.8	9.7	5.8
September	8.4	9.8	6.7
October	7.8	9.6	∞
November	7.2	9.8	
December	5.9	9.0	3.5

Atmospheric Pressure.—The range of the barometer on the coastland is slight. The average height is 29.900 inches or 1,122 milibars. There are, however, well-marked diurnal variations in pressure, the maximum pressure during the day being attained between 10 a.m., and noon, while during the night a lesser maximum is attained between 10 p.m., and midnight. The only definitely significant variation in the mean barometric height is just before the setting-in of the long periods of heavy rainfall when the barometer shows a very slow and slight, but continued, depression for 10 days to as much as a fortnight previously.

Atmospheric Humidity.—The percentage of complete atmospheric humidity varies from a maximum of about 86 per cent. at 6 a.m., to about 70 per cent. at 1 p.m., and to about 79 per cent. at 6 p.m.

New Amsterdam, Berbice; and Suddie, Essequibo.—Climatic observations at New Amsterdam, Berbice; and at Suddie, Essequibo, to the eastward and westward of Demerara, respectively, and at distances of about 5 miles from the coast-line in the estuaries of the Berbice and Essequibo rivers indicate that, while the mean shade temperature differs only slightly from that recorded at Georgetown, the range of the absolute maximum and minimum temperature is considerably greater, from about 66° as a minimum to 95° as a maximum.

Penal Settlement, Mazaruni River.—A sub-station has been at work at the Penal Settlement, Mazaruni River, in longitude 58° 38′ 45″ W. and latitude 6° 23′ 35″ N. at a distance of 42 miles south of the coast-line, for over 25 years. Here the mean temperature in the

shade is somewhat less—about 2° Fahr. than that of Georgetown, the range of the absolute minimum and maximum temperatures being from 66° to 92°.

The annual rainfall at Mazaruni is, distinctly more than that of the coastland stations, having amounted during the last 25 years to 102.8 inches a year as compared with an average of 89.5 inches recorded on the various coastland stations. The number of days on which rain falls in each year at Mazaruni is as a rule greater than that at Georgetown, the number of such days being approximately 20% higher at the former than at the latter. Another well-marked difference in the climatology of Mazaruni and Georgetown is the lesser number of hours of bright sunshine recorded at the former place—an average of 5.4 hours per diem as compared with 7.2 hours during the same period of years.

South of the Penal Settlement.—Southwards of the latitnde of the Penal Settlement a well-marked increase in the amount of the total annual rainfall is noticeable, for instance at Tumatumari, Potaro river, where during the past 20 years, the average rainfall has been approximately 113.5 inches, and in the Mahdia valley, near the Eagle mountain range, where the average rainfall has been over 150 inches a year. Unfortunately no other reliable continuous records of rainfall exist in the far interior of the colony, but it is certain that the rainfall along the escarpment of the Kaieteurian sandstone is, as a rule, in excess of that recorded in the Mahdia valley.

Ruvununi Savannah.—Unfortunately it has not been feasible to establish climatic or meteorological stations in the far interior and in the high plateaus of British Guiana. Two stations were worked for relatively short periods of years at Eupukari and at Dadanawa in the Rupununi savannah district. At the former, 223 miles south of the coastlands, the average annual rainfall was 46.2 inches during a period of years when that of the coastlands generally was 87.8 inches, while at the latter, 280 miles from the coastlands, the rainfall was

recorded at 58.5 inches during a relatively dry period of years on the coastlands when the average annual precipitation was 84.7 inches. The monthly distributions of the rainfall at the two stations were as follows:

		Eupukari.	Dadanawa
January	...	1.51	1.34
February	...	1.00	2.00
March	...	1.62	2.20
April	...	4.42	5.56
May	...	8.37	7.84
June	...	12.09	13.61
July	...	9.26	10.44
August	...	5.17	8.14
September	...	1.39	2.56
October	...	.39	1.65
November	...	.27	1 06
December	...	1.09	2.05

The mean temperature in the shade at Eupukari was 81.7°, the extremes noted being a maximum of 99° and a minimum of 66°. The average atmospheric humidity as percentage of saturation was 94.5 at 6 a.m., 74.1 at 1 p.m., and 76.3 at 6 p.m. At Dadanawa the mean shade temperature was 82.8, the maximum recorded in the shade being 103°, while the minimum was 66°.

Sir Robert Schomburgk's Views on the Climate of British Guiana.

Sir Robert Schomburgk during his residence in the Colony, and his travels in its far interior from 1836 to 1844, took numerous climatalogical observations, but these necessarily extended at any one place for a very restricted period of time, and therefore it is not feasible to draw any deductions from his published data. But in 1840 Sir Robert Schomburgk placed on record his views on the climate of British Guiana in the following terms:—

"Though Guiana is situated in the torrid zone, it "enjoys comparatively a more temperate climate than

"other countries under the same latitude. The mean "temperature for the year is 81.2°, the maximum 90°, "the minimum 74°. It is generally considered that two "wet and two dry seasons constitute the changes during "the year. However regular the setting-in of these "periods may have been formerly, this has not been "the case during later years. The great dry season "commences at the coast region towards the end of "August, and continues to the end of November, after "which showers of rain follow to the end of January; "the short dry season commences in the middle of "February, and continues to the middle of April. The "rains descend afterward in torrents, and the rivers "commence to inundate their shores. During that "period the wind is frequently from the west and "south-west, and, coming from the land, is thought "unhealthier than the regular sea-breeze, which during "the dry season begin to set in between ten and eleven "a.m., and continues until sunset, sometimes even "through the night. The months of October and "November are the most delightful in the year; the "sky cloudless, the heat moderate, and the thermometer "at noontide scarcely higher than 85° Fahr. During "the rainy season the oppressive weight of the atmos- "phere is tempered by northern breezes, and in the "months of September to November the breezes from "the east and south-east, which have passed over a vast "extent of the ocean, are invigorating, and refresh the "air to such a degree, that during the night the ther- "mometer has been known to fall to 74° Fahr."

"The moisture necessary to maintain vegetation is "then replaced by dew; and not only in the interior, "where the country is not extensively cleared, but like- "wise in the open savannahs, the trees and plants will "be found in the morning dripping with dew."

"The change of the season is marked by severe "thunder-storms; but however loud the peals of thun- "der may reverberate, and however vivid the flashes of "lightning which precedes them, fatal accidents by "lightning are unknown in Guiana. Gales are scarcely

"known, much less those terriffic phenomena of nature "hurricanes, which in the neighbouring islands destroy "in a brief time the fruits of many years' labour, caus-"ing devastation and loss of life to a vast extent."

"A few shocks of earthquakes are occasionally felt, "but they are so insignificant that the inhabitants "scarcely notice them when they occur."

"The temperature of the interior is still more mild, "and the climate healthy. The season in the interior "is only marked by two changes; from the month of "August to the month of March there are only "occasional showers, but from March to August the "rains descend in torrents, and the rivers commence to "swell and overflow their banks to a greater or lesser "extent according to their locality."

"The night is generally from 8° to 10° degrees "cooler than the day. A greater difference prevails "however at the table-land, from which Roraima rises "to a height of 7,000 feet; there I have known a "difference of 35° in the range of the thermometer, com-"pared at the hours of five in the morning and two in "the afternoon. At this table-land, which was only "elevated about 3,000 feet above the sea, the ther-"mometer half an hour before sunrise ranged between "59° and 62°, and rose between two and three o'clock "in the afternoon to 95° in the shade."

"The climate of British Guiana has been described "as unhealthy, and detrimental to European settlers; "consequently emigrants have rather preferred en-"countering the chilly blasts and severe winters of "Canada and the United States, or to subject them-"selves to horrors of a prolonged voyage to Australia, "there to suffer expatriation perhaps for ever from "their native homes and families, than to settle in a "colony where constant summer prevails, and which, "with the nigh establishment of regular steam-boats to "those parts, may be reaehed in sixteen or seventeen "days from England."

From a geological point of view it is to be regretted that the climatic records of the interior of the

Colony are so imperfect, for the weathering and lateritisation of its rocks are dependent on the amount and distribution of the rainfall and on the average temperature; whilst their splitting-up, detrition and degradation are largely dependent on the high temperature—150° Fahr. and over—which rocks in the tropics may attain when exposed to the full rays of the sun, and which high temperature may fall to 65° or even to 60°, by terrestrial radiation during the night.

PIGEONS.

By S. N. BRUCE, M.V.D., Veterinary Surgeon to the Municipality of Georgetown; Acting Government Veterinary Surgeon.

What Pigeon Raising Means.

The business of breeding pigeons offers generous profits, but both it and the birds must be well understood before it is gone into extensively. There is a false impression—unfortunately supported by misleading, unreliable advertisements—that any one can succeed with pigeons and quickly amass a handsome profit. Let no one take up the work with such an idea in mind, or he is likely to add his name to a long list of failures.

Start on a small scale, increasing as experience and returns warrant, be prepared to invest careful judgment, intelligent care, and plenty of work.

The pigeon industry has two branches, the breeding of squabs for human consumption, and the raising of breeding stock for sale. The first brings the surest and quickest returns, squabs being safely turned into cash at 4 to 6 weeks of age. The second requires more room for raising the young, also more care, more feed, more

cleaning of the houses, and often involves more losses, but the advantage is better price for stock sold, if of good quality. Squabs bring from 48 cents to 96 cents per pair according to size, good mated breeders bring from $1.25 to $5.00 per pair according to the parent stock.

Select breeders with great care, there are lazy, worn out and worthless individuals in all breeds. Economize, if you must, on the number of pairs, never on the price of the birds, for cheap stock produces few and undesirable squabs, may breed disease and in many cases soon wears out. If possible be familiar with the different types and breeds, selecting thereafter from stock raised by reliable dealers. Buy in small quantities (5 to 10 pairs is enough at first) and only mated pairs. It is well to buy from several sources rather than one, in order to obtain different lines of breeding and insure healthy, vigorous young stock in the future. If possible insist on having "seamless banded" birds. These have a seamless metal ring attached when about two weeks old bearing a number and the year it is hatched. To do this hold the three front toes together and slip the band over them, holding the back toe up close to the leg until the band is slipped up over it. Open bands of metal, celluloid, etc., may be put on at any time and do not guarantee the bird's age. Two-years-old breeders are best, yearlings second best.

The Different Breeds of Pigeons.

Of the many breeds and types of fancy Pigeons, the most popular are the Fantail, Pouter, Pigmy Pouter, Carrier, Jacobin, Archangel, Magpie, Nun, Swallow, Trumpeter, Barb, Turbit, Owl, and Trillback. Among the so-called sporting breeds are the Flying Homer, the Tumbler, the Tippler, and the Roller, Runts, Maltese Hens, Shaw Homers, Dragoons and Duchesse are bred as either fancy or utility stock found chiefly abroad.

Very few varieties of pure-bred stock are found locally. Here and there we may find a depleted stock

of Flying Homers, Tumbler, Roller, Runts, and Maltese. Runt-Maltese crosses predominate locally.

BREEDS FOR TABLE.

There are varieties to suit all tables and the beginner should study the demand he is to supply before choosing his stock. If a six-pound-to-the-dozen squab is most suitable, select Homers, if an eight-pound-to-the-dozen, choose extra-large Homers, Maltese, or Runts.

Runt-Maltese crosses etc., are all good. The special advantages of cross-bred stock are uniform and increased size, vigor and tameness. Contrary to its name, the White Runt pigeon is the largest of all breeds.

HOUSING.

The site is as important as the building itself choose a high, dry spot with good drainage where the flying pens may be on the south or east side of the house. If one or two sound trees are in the way of the pen they need not be removed. Simply take off the lower branches and build around them ; the top will provide desirable shade.

The building—The design and size must depend on (a) the number of birds to be kept and (b) the taste of owner or the style of the surrounding buildings. For a small beginning, with probable growth in mind, a good pen is a simple shed roof affair 8 ft high in front, 6 in the rear, 15 x 15 feet in size. This makes a unit which may be added to as fast as necessary, a solid board partition being built between each 2 pens. A pen will hold 24 pairs of large breeders or 28 of small, providing the combination, grit, water and feed box is used and the floor space left entirely clear. If no stock is to be reared above squab size, or if it can be kept elsewhere, the adjoining nursery pen may be changed into a breeding pen by substituting nests for perches. A good plan for the beginner in such a case is to start with one breeding pen, use the second as a nursery the

first year, then turn it into a breeding pen the next season.

General Management.

Feeding—Feed pigeons twice a day, as early as possible in the morning and 3 or 4 o'clock p.m. Give only as much as they will clean up in half an hour, and if any is left over give less at the next feeding. Never feed on the floor, but on tables 2 ft high, which must be scraped clean of all dropping before each feeding if they are to be any better than the floor. All grains fed must be free from must, or mold. Musty, moldy, mousy feed will surely cause heavy losses of both old and young birds. Corn and split peas should not be stored in quantity as they have a tendency to heat and become moldy.

Grit and charcoal—A generous, unfailing supply of sharp grit and charcoal is as necessary as feed.

Salt—Pigeons require salt but too much is more harmful than too little. A lump of rock salt placed in the centre of the grit box draws moisture from the air and gives the grit the slightly salty flavour that pigeons crave and no more. Never sprinkle it with water. Loose table and crushed rock salts are unsafe.

Water—Give a fresh supply of water with each feeding in a vessel that can bekept thoroughly clean. A good plan that makes scalding unnecessary is to hang a clean paint brush near the drinking pan and each night wipe the sides and bottom of the pan with it, then rinse the vessel and leave it upside down to dry.

The Bath—Pigeons are very fond of bathing and a large shallow pan should be kept in the flying pen. A galvanized iron vessel 2 feet square and 5 inches deep will generally serve. Empty it after the bath and turn it over so the dirty water will not be used for drinking.

Cleaning and vermin—Clean the loft well once a week, scraping all exposed places with a three-cornered loft scraper or sharp hoe. After removing the manure

dust slaked lime around; occasionally give the pens a good coat of whitewash. Body and feather lice and mites pray upon pigeons kept in filthy quarters and denied a frequent bath. Squabs are sometimes actually "eaten alive" and old birds so worried they are unable to sit on eggs or young. To prevent this dust the birds with a good insect powder twice a year by hand: and keep the pans clean and the nest disinfected with kerosene, turpentine, diluted crude carbolic acid, or a few moth balls.

DISTINGUISHING SEX—The male may be distinguished from the female by its larger, coarser appearance, thicker neck, and coarser head; it does the more and louder cooing and all the "driving." It is said that if a bird is held with its feet in one hand and the beak in the other and raises its tail, when suddenly stretched it is a female, but this test is not always nfallible. The only way to be sure is to wait until the hen has laid.

MATING—Pigeons breed in pairs and any unmated bird of either sex in the breeding pen will greatly disturb the workers and cause considerable loss of eggs and squabs. The cock and hen selected for mating should be confined together in a small pen or in a double nest they are to occupy in the breeding pen for several days until thoroughly mated.

NESTING—When a pair is mated the cock bird drives the hen about the pen almost constantly, hardly allowing her to eat and drink. He is not satisfied until she returns to the nest, and keeps up the driving until the first egg is laid. Fine tobacco stems, straw, dried grass, or shavings may be placed within reach.

HATCHING—Pigeons lay 2 eggs before sitting, 2 days apart. The period of incubation is 18 days, during which the cock sits on the eggs from the middle of the forenoon until mid-afternoon, and the hen the rest of the time. For the first 4 or 5 days the tiny squabs live on "pigeon milk" a cream like substance that forms in the crops of both parents at the end of the

hatch. The old bird takes the baby's beak gently into its own and pumps the soft feed slowly into the little mouth, After this milk is fed off, half digested grain is pumped into the squab and later whole grain with water and grit,

BANDING—Each squab that is to be raised for breeding should be banded when 2 weeks old with a seamless metal ring bearing a number and the year it is hatched.

DISEASES.

Disease among pigeons is more easily prevented than cured. The general causes are dampness, draughts, unclean or crowded quarters, moldy or too new feed, slimy drinking vessels, inbreeding, unhealthy parent stock and over feeding. It is not good to be continually giving drugs, though a good tonic may be given all the birds occasionally in the drinking water with good results.

A sick pigeon is easily recognised, it has a general appearance of misery, standing around in a huddled position, feverish, glassy-eyedand without appetite. It should be immediately removed from the pen and carefully examined for the following diseases :.

ROUP—an extremely contagious disease of the nose and throat, caused by insanitary quarters, dampness, bad ventilation.

Symptoms—watery and swollen eyes, running at the nose.

Treatment—remove to a warm dry place apart from the flock. Give a pinch of epsom salts daily. Feed a light diet, with a few crystals of potassium permanganate in the drinking water.

CHOLERA—a dangerous disease that often destroys a whole flock in a short time. caused by filthy drinking vessels, moldy feed, new unseasoned corn, etc.

Symptoms—severe diarrhoea ; emaciation.

Treatment—remove and give daily 3 drops of "hot drops" such as Jamaica Ginger on a piece of charcoal as big as a grain of corn; feed lightly.

WORMS.—Squabs or old birds that eat heartily but are very thin have intestinal worms.

Treatment—feed lightly and give a pinch of worm seed twice daily for 2 days then 5 drops of castor oil.

GOING LIGHT.—A wasting away disease that resembles consumption occuring mostly among youug birds, and caused by overfeeding and lack of exercise or foul water or feed.

Symptoms—high fever and severe chills, watery and mucous discharges; difficult breathing (*dyspnoea*); emaciation.

Treatment—this disease can be cured only in its earliest stages before inflammation of the lungs has set in. Give a No 2 capsule filled with phosphate of soda each morning for 3 days, diet lightly.

CANKER an incurable hereditary disease much dreaded by pigeon fanciers.

Cause—tainted stock transmits it through the egg.

Symptoms—external and internal growths of solid yellow matter streaked with blood, appear commonly in the ear, throat, head near the eye, etc.

Treatment—birds may be cured to all outward appearance but sooner or later it appears again. The best, plan is to kill all birds that are known to breed cankered young or that show canker and thus stamp out the disease for once and all.

DIPHTHERIA,—a disease of the throat often mistaken for canker, attacking 2 or 3 weeks old squabs and caused by sudden changes of weather, heat and dampness.

Symptoms—throat and neck are red and much swollen, causing difficult breathing (*dyspnoea*); thick, yellow discharge from mouth.

Treatment—bad cases cannot be cured but light cases may be by swabbing out the throat several times

daily with cotton dipped in witch hazel. Stubborn patches may be removed by dusting with baking soda and swabbing them off after a few minutes. Disinfect the drinking water by adding enough potassium permanganate crystals to turn it a bright rose red.

SQUAB TONIC.—A half ounce of copperas, 4 ounces of sulphate of soda ½ ounce powdered gentian, 2 ounces of phosphate of soda, 1 drahcm of pure creosote (beechwood). Thoroughly mix the creosote in a mortar with 40 grains calcinated magnesia, so that it will mix with water; pour into a gallon jug, add 2 quarts warm water, then the other ingredients, and mix thoroughly by rocking the jug. This will keep for years in a cool place but not in a metal container. Add one tablespoonful to a gallon of drinking water once a week.

THE CULTIVATION OF THE GROUND-NUT.

The following is an extract from an Article on The Cultivation, Preparation, and Utilization of the Ground-Nut in Vol. XXIII., No. 3 of the Bulletin of the Imperial Institute.—Editor.

EXTENT OF CULTIVATION.

The cultivation of the ground-nut extends over a very wide geographical area. The crop is successfully grown in most of the tropical and sub-tropical regions of the world, and also, to a certain extent, in countries where a temperate climate prevails. The ground-nut is used either locally as food, or as an article of export on account of the value of the seeds as a source of oil and of the residual cake as a feeding stuff.

THE GROUND-NUT PLANT

The ground-nut of commerce is known under several common names, such as pea-nut, goober-pea, earth-

nut, monkey-nut, pindar Manila nut, Chinese nut, pistache de terre, Parachide, and in the vernaculars of India and other countries where it is grown, by translations of one or other of the names mentioned.

The plant which produces the ground-nut is known botanically as *Arachis hypogæa*, Linn. It is unknown in a wild state and its native country is a matter of some uncertainty. There is reason to believe, however, that it originated in tropical South America, as several species belonging to the genus Arachis are met with growing spontaneously in that country. Centuries of cultivation have probably so improved the plant that it is no longer comparable with the wild type, if this is still in existence.

The ground-nut plant is an annual herb belonging to the Papilionatæ division of the large family Leguminosæ, whose members are characterised by pea-shaped flowers. In general habit and appearance the plant resembles the clover. The leaves, however, differ from those of clover in having four instead of three leaflets These are arranged on the leaf-stalk in two pairs, and they exhibit at night the sleep-movement characteristic of the leaves of many leguminous plants. The stems attain a length of from 1 to 2, or 3 ft., according to the variety and the soil in which the plant is cultivated. There are several forms of it in cultivation, but in general two types may be recognised, the erect and the trailing. The varietal differences are chiefly in the shape of the mature pod, the number and colour of the seeds they contain and the manner in which the pods are produced on the stem of the plant. The flowers are bright yellow in colour and are of two kinds. Those that are borne above the leaves and are the most conspicuous are sterile and produce no pods. The fertile flowers are borne in the axils of the lower leaves in the erect-growing kinds, and all along the stem in the trailing varieties; they are smaller but more numerous than the sterile flowers and are almost entirely hidden by the foliage. When first produced, these flowers are sessile,

that is to say they have no peduncle or flower-stalk; but the tubular calyx, which encloses the ovary, is often $\frac{3}{4}$ in. in length, and is sometimes mistaken for the flower-stalk. After fertilisation takes place the true peduncle develops, and continues to grow until it reaches a length of several inches. It takes a downward turn, and when it reaches the soil, it pushes the ovary several inches beneath it. In this position the ovary develops its seeds and in a few weeks the pod matures, forming the familiar ground-nut of commerce. If the stalk is prevented from penetrating the soil, no seeds are produced and no pod is formed. This peculiarity is of importance to the cultivator, as it indicates how essential for this crop is a fine surface tilth on the soil, which enables the delicate flower-stalk bearing the ovary to penetrate it easily. When mature, the pod may contain from one to as many as four seeds, according to the variety, but two is the usual number. The seeds are generally ovoid in shape with one end pointed and the other flattened, and are covered with a reddish-purple or yellow seed-coat.

In common with other leguminous plants, the roots of the ground-nut plant bear nodular growths. These are due to the action of bacteria which inhabit them, and which have the power of fixing the free nitrogen of the atmosphere and rendering it available for the plant which serves as host. In consequence of this the ground-nut plant does not depend entirely upon the soil for the nitrogenous food it requires, and it is thus possible to cultivate ground-nuts on soils which are not particularly rich in nitrogenous constituents.

Cultivation

The ground-nut is not a difficult crop to cultivate provided the few essential conditions are forthcoming. The details of cultivation naturally differ in countries so widely seperarated as the regions mentioned above, but the following account gives the general procedure in most countries.

Climatic Conditions

In tropical countries the life cycle of the ground-nut plant is accomplished in from three to four months according to the variety. In more temperate regions some five to six months may elapse between the time of sowing the seed and the maturing of the fruit. It is apparent from a study of the geographical area over which the ground-nut is cultivated that it is possible to grow the crop under climatic conditions which differ considerably. In tropical regions there is always sufficient heat for this crop, and the only uncertain element is the rainfall; but the crop can be grown under irrigation, where the rainfall is scanty.

In tropical countries with well-defined wet and dry seasons the ground-nut crop is cultivated during the rains, and the whole of the vegetative growth is completed during the wet season. The sowing takes place as soon as the rains have sufficiently moistened the soil, and by the time the dry weather sets in the crop is mature and ready for harvesting.

Soil

The first condition required of a soil destined for the cultivation of ground-nuts is that it should have a fine surface tilth. The necessity for this arises from the peculiarity of the plant, already mentioned, in burying its fertilised ovaries beneath the soil in order to mature the seeds A fairly rich sandy loam appears to be the most suitable soil for the crop, and it is an advantage if it is light in colour as the pods are liable to be stained if grown in a dark-coloured soil. When required for sowing or for oil-pressing, the appearance of the pods is not of great importance, but when the seeds are to be used for edible purposes, light-coloured, clean pods fetch an enhanced price on the market. Abundance of lime is essential for the crop and where lime is lacking it should be added in the form of quicklime. The absence of lime from the soil is supposed to account for the production of "pops"

or empty pods. A fair amount of humus or decayed vegetable matter is beneficial, but if too plentiful the haulm is liable to develop at the expense of pods. *Badly drained, sour, salt or clayey soils are unsuited to the crop*, but good yields have been obtained from stony soils rich in sand where a plentiful supply of sub-soil moisture is available.

Preparation of the Soil

If new country is being brought into cultivation it will be necessary to cut down trees, shrubs or undergrowth, should they exist, and these should be burnt on the land as the ashes form a valuable manure for ground-nuts. In countries where primitive methods of culture are practised the land is simply hoed by hand to a depth of from 2 to 4 in. In sandy soils the surface is left level, but in more compact soils it is thrown into ridges to afford better drainage. Where mechanical appliances are available the land is ploughed a short time before sowing if a previous crop has been taken off it; but if it is to be newly broken, the preliminary ploughing is carried out in autumn and is followed in spring by rolling and harrowing to break up the clods and render the surface smooth and friable. The depth of ploughing depends entirely on the character of the soil, but from 5 to 7 in. of loose soil is sufficient depth for the ground-nut. If the land is deeply cultivated the nuts are liable to be formed low down in the soil and this involves more labour for harvesting them, Where there is no manure to be turned in and the land is level and in a clean condition, the disk plough as used in the United States, is a useful machine for producing the fine surface tilth required by the crop.

It is advisable to cultivate the ground-nut as a rotation crop, as not only does this practice prevent the exhaustion of the soil, but the alternating crops are benefited by the good culture which the ground-nut demands and by the increased amount of nitrogenous matter contained in the soil as the result of having borne a leguminous crop. As, however, the whole

plant, including the roots, is harvested, the soil does not benefit to the same extent as it does when a leguminous crop is ploughed in as manure. Local practice and demand will to a certain extent determine what plants to use as rotation crops with ground-nuts; amongst others that have proved suitable are maize, millet, sesamum, cotton, tobacco, and manioc (cassava) The alternation of other crops with the ground-nut has the further advantage of checking the attacks of insect pests which are liable to occur when the crop is grown on the same land for several years in succession.

Manures

Advantage should be taken of the rotation system of cropping to apply farmyard manure to the land, but if this is done the same year that a crop of ground-nuts is grown, the haulms are liable to make rank growth at the expense of the nuts. It is therefore advisable to manure the crop which immediately precedes the ground-nuts.

In addition to farmyard manure, artificial fertilisers may be used with advantage if the soil is poor, but care should be taken not to overdress the land or luxuriant top growth will be the only result. These fertilisers should contain from 1 to 4 per cent. of available nitrogen; 5 to 7 per cent. of phosphoric acid and from 6 to 10 per cent. of potash.

Wood-ashes which contain both lime and potash may be applied broadcast to the land at the rate of from 25 to 30 bushels per acre. Soils that are deficient in lime should receive dressings of fresh burned lime every four or five years at the rate of from 1,000 to 2,000 lb. per acre.

Sowing

Care should be taken to use only good seed for planting. With native cultivators it frequently happens that only the unsaleable nuts of poor quality are available, and to this is probably due the degenerate crops and poor yields which obtain in some localities.

In order to produce good results and to improve the crop, seeds should be saved from the best yielding plants and these should be grown in nurseries and carefully harvested for sowing in the field the following year. The nuts intended for seed should be fully matured on the plants and should be carefully picked by hand and stored in a dry place free from attacks by vermin.

Either the whole "nuts" or the decorticated seeds may be used for planting. If the former are used the germination of the seed is delayed until the shell has decayed and permitted the young plant to escape. This takes but a few days in tropical countries where decay is rapid, but in dryer and cooler regions the use of whole nuts for planting causes an appreciable delay in germination. The germination of whole nuts may, however, be accelerated by soaking them in cold water for about twenty-four hours and allowing them to drain for a few hours before planting. Another method of accelerating the germination of undecorticated seeds is simply to break the pods in two, leaving the seeds *in situ*. Where decorticated seeds are used the pods should be opened by hand and care taken not to injure the delicate seed-coat, as injury or bruises are liable to be followed by decay after the seed is planted. One of the advantages of shelled seed is the opportunity afforded during the shelling for eliminating any that are defective, hence the better "stands" that usual result when decorticated seeds are sown. The seed to be used for planting should not be shelled until a short time before it is required for use, as it is liable to lose its power of germination.

The seed is usually sown in straight rows or drills, an where hand-planting is practised the land should be first marked out. This is easily done by means of an improvised harrow with teeth set at the required distance. The seeds may be dropped in the lines made by the harrow at regular intervals and covered with soil by the foot. The depth at which the seeds should be planted varies from 1 to 1½ or, 2 in., according to the

character of soil. The heavier the soil, the shallower should be the planting. The distance between . the rows depends upon the variety grown, and local conditions; and also as to whether hand or machine cultivation is to be employed. If the latter, the rows must of course be spaced sufficiently wide apart to admit of the working of the machine cultivator. A common distance for planting in the United States is 36 in. between the rows and 12 in. from plant to plant. If planted too thickly the branches of the trailing varieties overspread each other, and many of the stalks fail to reach the ground, and in consequence do not form pods ; on the other hand the erect varieties, if planted too thinly, do not cover the ground and the crop is liable to suffer from drought in consequeuce. Experience of the local conditions and of the habit of the variety grown, is the only safe guide on this point, but not less than 1 ft. or more than 3 ft. between the rows should be given. Should serious gaps appear in the rows a supplementary sowing will be necessary, and this should be carried out as soon as possible after the plants from the first sowing appear above the ground ; or seedlings may be transplanted to fill the gaps.

After-Treatment

At soon as the young plants have attained a height of from 1 to 2 in., the soil between them should be hoed. Where machines are available the horse-hoe or cultivator can be used for this purpose and much hand-labour saved thereby. Frequent hoeing is necessary, as this operation not only checks the growth of weeds and prevents the evaporation of moisture from the soil, but also produces the necessary fine surface tilth. The number of hoeings necessary will depend upon the character of the soil and the rate at which the weeds grow, but as soon as the haulms have developed sufficiently to cover the soils this work may cease. In making the later hoeings the soil should be drawn towards the plants, and this should be carefully done or the first-formed pods may be injured.

Harvesting the Crop

In tropical countries the stems begin to fade as soon as the rains have ceased and the dry weather has set in. This is an indication that the plants are ready for harvesting. It is advisable to lift the plants as soon as the stems show sign of fading, as then the pods are firmly attached to the stem and are not so liable to be detached during the process of lifting. Care must, however be taken to see that the maximum number of nuts are mature, as they ripen successively In the case of compact soils, which retain moisture for a considerable time, a longer period for ripening is required. The ripening season is a critical period, as if rain falls before the crop is lifted, after a spell of dry weather, the seeds in the first-formed pods are liable to start into growth, and are then of little or no value as oil-seeds. For this reason also, when the crop is grown under irrigation, the supply of water must be so managed that it is just sufficient to mature the crop, and it must not be continued after the first-formed nuts are mature.

There are various methods of harvesting the crop. Native cultivators either use a large hoe with which to lift the plants, or dig up with a fork.

The Chinese cultivator harvests his crop very thoroughly. He lifts each plant with a spade-like implement and throws it, together with the soil which adheres to the roots, into a bamboo sieve which is shaken by another operator. The soil passes throug the meshes of the sieve and the pods are retained. Any chance pods that escape are gleaned, or poultry and pigs are turned into the fields to feed on them.

Picking the "Nuts"

The separation of the pods from the stems is usually effected by hand, where the necessary labour is available. This is a tedious and expensive method, but, as it is not laborious, women and children engage in the operation. The pods should not be picked until they have become quite dry and the seeds firm and

nutty, and empty or shrunken pods should be allowed to remain on the stems.

After being plucked or thrashed the pods should be spread out to dry and then put into sacks or stored in granaries protected from rain. In the tropics, where a long period of dry weather can be depended upon they are stored in large heaps before being shipped.

Yield

The yield varies with local conditions and the variety grown, and more especially with the amount of cultivation the plants receive. With proper methods of cultivation a good average yield is about 60 bushels per acre, though yields of 100 to 160 bushels per acre have been recorded.

Varieties

In nearly every country where ground-nuts have been cultivated for a long period of time, varieties peculiar to the locality have been produced. From this it would appear that by following a systematic course of seed-selection, it would be possible to obtain varieties suited to particular localities, to special soil or peculiar climatic conditions. Already much has been done to improve the yields in countries where they had detoriated by introducing new varieties or seed obtained from other localities. Where fungoid pests are prevalent it seems particularly advisable to follow this course, care being taken to obtain seed from sources known to be free from disease. Hitherto, very little appears to have been done, however, in the production of new varieties by breeding on modern genetic lines.

Pests and Diseases.

Although all parts of the ground-nut plants are liable to damage by insects, yet few pests appear to attack well-cultivated crops of ground-nuts when in

the field. In West Africa the plants are liable to attack from a number of insect pests, but they are usually able to withstand such attacks if growing vigorously. In dry seasons, however, they may be affected by the drought and then more easily succumb to insect attack. It is important therefore, during a dry season, to keep the surface soil hoed in order to produce a dry mulch which prevents evaporation of soil moisture, and this, by keeping the plants more vigorous, tends to check the ravages of insect pests.

CULTIVATION OF GARLIC.

Lnnd.—It should be grown as a garden crop, and succeeds best in a well-drained rich soil. This should be manured with well-rotted cattle dung and dug up to a depth of 4 to 6 inches. The land should then be well trampled down and reduced to a fairly fine tilth.

Sowing.—Plant bulbs 6 to 9 inches apart and cover with about 1 to 2 inches of soil. About 750 lbs. of bulb are required to plant an acre. Keep the land well weeded, and if the surface soil becomes hard, break it up gently with a small fork or stick. Water every three to four days if there is no rain.

Harvesting.—Crops take about four months to mature. They must, therefore, be planted so that they mature during dry weather. When the leaves begin to turn yellow the crop is ready to harvest. Crops should be lifted carefully, freed of earth, and then thoroughly dried in the sun. Yields of 2,000 to 3,000 lbs. of dried garlic per acre can be obtained.

F. A. STOCKDALE,

Director of Agriculture, Ceylon.

Land.—Onions grow best in a rich soil, but any land, if it is properly drained and well cultivated will grow onions. The land should be manured with well-rotted cattle dung and dug up to a depth of 4 to 6 inches.

Sowing.—Onions can be grown from seeds or from bulbs. In general it is safer in Ceylon to grow onions from bulbs, as seed does not grow well unless it is quite fresh, and beds of seedlings may easily be destroyed by heavy rains. When seed is used, the seed beds must be very carefully prepared and the soil reduced to a fine tilth. The seed beds must be trampled down before sowing as an essential to success in onion growing is that the seed bed should be firm. About 15 lb. of seed is required per acre. The seed sshould be sown in drills 6 to 9 inches apart, and the seedlings thinned out as they grow to about 6 to 9 inches apart. Seedlings thus. thinned out may be transplanted.

If bulbs are used, these should be planted 6 to 9 inches apart and covered by about 1 to 2 inches of soil About 750 to 1,000 lb. of bulbs are required per acre and therefore this method is expensive.

Cultivation.—Onions should be kept free of weeds and must be watered every three to four days if it does not rain.

Harvesting.—Crops take three months from bulbs and four months from seed. If they are being grown for drying, they must, therefore, be planted so that they mature during dry weather. When the leaves begin to turn yellow the crop is ready to harvest. Onions should be lifted carefully, freed of earth and roots, and then well dried in the sun. If they are not properly dried before they are stored, they will rapidly rot. Yields of 4,000 to 8,000 lb. Of dried onions per acre are common, and in planting from bulbs five to eight-fold can be secured. Heavy yields are only obtained if the land is well cultivated and manured.

F. A. STOCKDALE,
Director of Agriculture, Ceylon.

KEEPING QUALITIES OF RIPE MANGOES.

The following Report by Mr. A. W. Bartlett, B.A., a former Government Botanist, on the keeping qualities of mangoes was published in Vol. II No. 2 of this Journal and is reprinted at the request of the Board of Agriculture.—Editor.

1. The experiment has been carried out with 260 mangoes belonging to 23 varieties picked at various dates between the 7th February and the middle of March

2. A tabulated statement of results is herewith submitted.

3. In all cases the mangoes were gathered in pairs, each pair at the same time. One was immersed in a 3 per cent. solution of formalin for ten minutes, the other merely kept as a control under exactly similar conditions. They were examined daily, and the dates when they became soft or rotten or mildewed noted.

4. Contrary to similar trials made with formalin on soft-skinned fruits the use of formalin was found to lessen instead of increasing the average number of days which elapsed before the mangoes became more or less unfit for eating, except with 3 varieties. Every care was used in handling the mangoes during the treatment with formalin to avoid bruising them and so hastening their decay.

5. One important fact that these experiments have shown is that, without any special precaution beyond care in picking and handling, most varieties of grafted mangoes will keep on an average for about 10 or 12 days, even in our climate. In cool storage it is likely that their keeping powers will be much increased.

6. During the earlier trials it was found that decay usually originated at the stalk end of the fruit, although the stalk had not been broken off. In gathering the fruit it must not be pulled, but the stalk must be cut.

because the pull required to break the stalk is sufficient to bruise the stalk-end of the fruit and cause decay to set in earlier at this place.

Tabulated Statement of Results.

Variety.	No. Tried	Average No. of days the Fruits kept		Average No. of days increase or decrease in keeping powers due to Formalin	Longest No. of days any Fruit kept	
		Treated with 3 o/o Formalin	Un-treated		Treated with 3 per cent. Formulin	Un-treated
1. Dare	20	7·8	9·8	—2	12	13
2. D'Or	18	9·3	11·1	—1.8	12	15
3. Ceylon	6	7·7	10·7	—3	8	13
4. Jamaica No. 11 ...	20	10·3	11·6	—1·3	14	16
5. Josephine	4	11·	14	—3	13	17
6. Seedling Madame ...	16	12·	12·	0	15	14
7. No. 2 Canal... ...	26	10·8	11·9	—1.1	16	16
8. Madame	32	12·2	13.9	—1·7	17	19
9. Chinoise	10	5·8	11·2	—5·4	8	15
10. Bombay 25	20	10·4	13·	—2·6	15	16
11. Peters	4	7·5	9·	—1·5	9	10
12. Martin	6	8·	6·3	—1·7	11	9
13. Bangalore	16	12·6	11·9	— ·7	19	14
14. Divine	4	9·	10·5	—1·5	10	12
15. Mrs. Francis ..	4	12·5	10·5	2	13	11
16. Peach	4	12·	17·	—5	14	20
17. Mrs. White	6	11·3	15·3	—4	14	17
18. Bombay 26	10	9·2	12·4	—3.2	12	15
19. Bombay 22	2	..	...	...	15	17
20. E. I. Seedling ...	4	12·	12·5	— ·5	12	[illegible]
21. Kerschapotte ...	12	9·3	10·5	—2·2	14	[illegible]
22. Crassous	10	11·6	12·8	—1·2	14	15
23. Bombay 27	6	10·	13·6	—3·6	11	15

FEEDING COTTON-SEED PRODUCTS TO FARM STOCK.

Practical experience has been supplemented by carefully conducted experiments, both in the United States of America and Europe, with cotton seed, cotton seed hulls, and cotton seed meal as food for cattle, sheep, pigs, horses, and mules with the result of demonstrating their high feeding value for all kinds of farm stock, with the possible exception of calves and pigs, to which they have frequently proved fatal.

The high feeding value of whole cotton seed has long been recognised, having been fed raw, roasted, steamed, or boiled to live stock, especially cattle. Almost from the beginning of cotton culture in this country it has been used to some extent as a feeding stuff, but since the introduction of the cotton-seed oil industry, the superior feeding quality of the by-product—cotton-seed meal—has led to a very general displacement of whole seed by the meal in localities where the latter is easily and cheaply obtained.

The value of cotton-seed meal for producing meat, milk, and butter is well established. It is one of the cheapest of the highly nitrogenous feeding stuffs and is therefore one of the most economical for balancing rations deficient in protein, such as those in which corn is the principal grain.

Although milch cows will do well for an indefinite period on cotton seed or cotton-seed meal as the sole grain food, it is better to add a second, such as corn meal or wheat bran to the ration. If fed to cows in large amounts without proper admixture of other feeding stuffs it is likely to injure the quality of the butter as regards flavour and colour. It appears, however, to harden the butter and thus to enable it to stand shipment better. It has also been found to facilitate very materially the rise of cream by gravity.

A reference to the analysis of cotton-seed hulls and meal will show that neither of them is adapted for use

alone as food. The hulls contain a large excess of non-nitrogenous matter and the meal a large excess of protein; each lacks what the other has in abundance. The meal is well adapted by its composition to be fed with the hulls, and the hulls find their proper supplement in the meal. The relation is so evident that the fact that it is was not pointed out much sooner is peculiar, although the uninviting character of the hulls as food doubtless had the effect of diverting both scientific and practical investigations from them.

The above combined results are obtained by the use of undecorticated cotton-seed meal.

—U.S. Dept. of Agriculture,
Farmers' Bulletin No. 36.

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WOOD FINISHING

BY

WILLIS T. POPE.

For some years I have been considerably interested in wood finishing, particularly that part which involves staining, filling and polishing. It is a great field of work, ever attractive and pleasing, to investigate. New matter and different results are constantly presenting themselves. Though wood finishing is one of the very oldest arts, and one that requires much knowledge of materials, as a craft we find little literature regarding it.

Good instruction in iron work and wood work can be procured easily in almost any of our industrial and manual training schools, but, as a rule, very few lessons are given in the finishing processes that go to make an attractive piece of wood work, whether it be a piece of furniture or the interior of a dwelling. As a people, we depend almost entirely upon untrained workmen for our information. Good polishers very seldom know much about materials and their sources. They have little information to give away, and the secret of their success, when found out, is about the same old receipt made good by hard rubbing.

In discussing briefly the subject of wood finishing, I will no doubt dwell upon particulars of which you are more or less familiar, but I trust the interest will be worth the short while taken.

No two species of trees produce wood, of exactly the same structure. There is a great variation in woods of the same species, in fact a distinct study in each separate piece.

Examine almost any piece of wood, and in a general way we find it composed of small cells of various kinds, usually long and tubular, running lengthwise, and adhering to each other more or less strongly. These cells have had special uses in the life of the tree, some were for conducting crude sap from the roots to the

crown, others acting as storehouses for digested plant food, and still others have long acted merely for strengthening the tree and holding it together. Investigation shows that some of the cells have thick walls and small openings, others, thin walls and large openings. Most specimens of wood have these different kinds of cells arranged or grouped together in such a way as to form the *annular rings* which are so distinct on the cross section of most lumber and give the beautiful watered grain to longitudinal sections.

When the growth of the trees begins in the spring or at the beginning of the wet season in most tropical countries, there is a great demand for water in the crown where the multitudes of new leaves and twigs are forming, hence a new layer of large, loose thin-walled cells is rapidly built; when the demand for crude sap is not so great, and when there is plenty of digested food to supply building material, the cells formed are narrow and thick walled, thus the latter growth of each season is heavier, stronger and darker in colour than the earlier growth. As long as the tree is in good condition, distinct rings are left, one for each year, which the foresters and lumbermen make use of in determining the age of trees of the forest. Fire or insects or anything of the kind damaging one side of the tree will often be the cause of incomplete annular rings. Seasons of drought leave narrow and indistinct rings that prove correct records of those dry years throughout the existence of the trees. These accurate records were very valuable to the parties who determined the great age of the grand Sequoias of California.

Other markings, peculiar and interesting, and that have much to do with the finishing of the species of wood, are the dappels of thin plates of cells belonging to the *Medullary rays.* These lines of cells run from the pith in the centre to the bark as longitudinal layers. Their function is to strengthen and bind the annual layers. Though they are present in most tree stems, they seldom appear more than as faint lines

radiating from the centre of cross sections. In oak they are very conspicuous and add great value to it. To get oak boards well marked with these medullary rays, the logs are cut into quarters, each quarter being ripped up into boards with their cutting plane oblique to the quartering cuts (or as near as possible along the lines of rays). This brings the surfaces of the boards nearer to the radiating medullary rays of the logs, thus giving many of the dapples on each surface. This quarter cutting greatly increases the cost of the lumber because of the waste, but at the same time increases its strength and enhances its beauty. Trees of the forest that yield the most handsome lumber with a beautiful and well marked finish are those which have plenty of room for growth, which are exposed to winds that cause them to bend and toss, and which have ample light and space for development.

The composition of wood is of importance to the wood finisher. It is briefly but well explained in "A Primer of Forestry." Bulletin No. 24 of the Division of Forestry, U. S. Department of Agriculture.

"Wood is made up chiefly of carbon, oxygen and hydrogen. When perfectly dry, about half its weight is carbon and half oxygen and hydrogen, in almost the same proportion as in water. It contains also about one part in one hundred by weight of earthy constituents. The nitrogen and water taken up by the roots were originally in the air before they reached the ground, it is true, therefore, that when wood is burned, those parts of it which come from the air go back into it in the form of gas, while those which come from the soil remain behind in the form of ashes."

The cell structure of most woods, as left by the smoothing tools of the workman, is so open that it is difficult to get a finished surface without using considerable expensive polish or varnish, which would have to be applied in thin coats with considerable time for each to become hard. This difficulty is overcome by the use of a *filler*; the name implies its object. A cheap, durable mixture is rubbed into the openings of the wood

forming a body, or foundation upon which the finish is to be placed. Very hard, close grained wood, as olive, lignum vitæ and some species of eucalyptus, do not need the filler.

Wood filler for many kinds of woods may be purchased ready for use. Cheap varnish is sometimes used as a filler, and shellac cut with alcohol makes one of the best for work where the pores are not too large. Large cracks may be filled with a composition consisting of rosin and beeswax. Two applications of filler, if well applied, are usually satisfactory for any kind of finish. (The second coat should not be put on until about 36 or 48 hours after the first). Too much of a single coat is apt to shrink away into the wood. Equal parts of *Japan drier* and *boiled linseed oil* thoroughly mixed with a body of *corn starch* to form a thick putty-like paste, thinned down to the desired liquid with turpentine, makes a filler that is suitable for most woods, Instead of corn starch, some earthy material as plaster of paris, whiting or pumice stone is sometimes used, but the old reliable corn starch has proven satisfactory.

Just a few words as to those materials that form the filler. Japan or Japan drier is a brownish liquid having somewhat the nature of varnish, called a drier on account of its property in paints, etc., is made by cooking gum shellac with linseed oil: the mixture is cooked down to a very thick fluid and then thinned with turpentine. Shellac is the shell form of *lac*, a resinous gum produced on several kinds of trees by a species of scale insect in the East Indies.

Boiled linseed oil, as most of us know, is a product of the flax seed obtained by placing the crushed seeds under great pressure, and the extracted oil then boiled with litharge (sugar of lead) which leaves a liquid varying from light umber to dark yellow in colour, with the property of drying quickly when spread in a thin layer. The turpentine, of course, is the liquid obtained from the rosin of several species of pine trees,

Fillers are usually applied with a brush, sponge or piece of cloth. A few minutes after the application the work should be rubbed vigorously with another cloth or a piece of canvas, first crosswise and then lengthwise. It is not uncommon to add a little chrome yellow, yellow ocher, venetian red or burnt umber or some other colour to the filer, which often improves the appearance of the wood. In finishing carriages, piano and small articles, it is not uncommon for the workman to use polish, rubbing into the fresh application finely powdered pumice-stone, just a little at a time. The object of this is two-fold, for levelling down and giving an even under-surface and to work a durable mineral material into the pores.

The *staining* of woods may be considered for several purposes.

First, to preserve the wood; second, to stain common woods to imitate superior classes, as the staining of common oak to give it the appearance of antique oak or as golden oak; third, staining to add uniformity or colour throughout a piece of work. Wood of the finest quality, no matter how carefully selected, will be given some staining medium when it passes through the French polisher's hands, which he claims is done to bring out the beauty of the grain.

Staining has become very popular for house furnishings of late years on account of its cheapness and the fact that it does not destroy the natural beauty of the wood. It is less expensive to keep woodwork fresh and clean, when stained, than it would be to apply successive coats of paint and varnish.

Stain may be applied as an opaque coating on roofs and the exterior walls of houses, and again it may be applied as a thin wash, giving colour to some depth, but leaving visible the character of the wood.

Some years ago, wood finishers used a great many vegetable dyes for colouring wood, and when a dry pigment was applied water was usually the vehicle used to carry it into the wood, but turpentine, alcohol or an oil has been found to be better, as it does not raise the

grain of the wood. If the liquid used as a vehicle to carry the colour pigment into the work is a good wood preservative, the stain will have double value, *i.e.*, to give colour and preserve. Boiled oil is highly recommended as such a liquid. A very good stain is composed of two parts of turpentine, one part of boiled linseed oil and a little Japan drier, these added to the colour pigment that is selected, *venetian red*, *burnt sienna*, *vandyke brown* or *chrome green* or some other colour. In such a stain the oil gums the pigment, the turpentine keeps it thin until deposited in the proper place and then evaporates, and the drier helps to set the mixture.

I am told that many stains are sold ready for use containing carbolinium, kerosene and various other oils that act as wood preservatives; denatured alcohol is also much used of late. Most of these are cheap and reliable. One gallon of liquid stain will cover about a hundred square feet, and after buying a few small sample bottles and finding a suitable one, you can usually rely upon getting a further supply to match. It is a good plan, and often saves much disappointment, if before staining, a few small pieces of wood are experimented with till the required result is obtained.

"Aniline" dyes may be usefully employed on wood for self-colours only—as distinct from various imitations of woods. Their introduction a few years ago, I am told, produced a disastrous effect on the old vegetable dye market, nevertheless many of the vegetable stains are exceedingly useful.

Logwood stain, made from boiling the chips of the logwood tree (*Haematoxylon*) is still a much used vegetable stain. This product is imported from Central America and the West Indies. We have a few specimens of these trees about Honolulu. It does well in most warm regions of the earth.

Other dye-woods worthy of mention are red sanders, orchella weed, safflower and nut-galls.

Many colouring materials are to be obtained from common plants. The well-known blueberry, when boiled down with a little alum and a solution of copperas

(sulphate of copper) will develop an excellent blue colour; treated in the same manner with a solution of nut-galls, it produces a dark brown tint; with alum verdigris and sal-ammoniac, various shades of purple and red can be obtained from it. A good green stain is obtained from broom corn.

Stain is usually applied with a brush, sponge or cloth, and on surfaced work, where the grain of the wood is to show, the excess is wiped off with a cloth in a few minutes after the application.

After a piece of wood has been stained, it can be given one or more coats of white shellac, smoothed with fine sandpaper and varnished. Varnish is a viscid liquid, consisting of a solution of resinous matter in oil or a volatile liquid laid on work to give it a smooth hard surface with a gloss.

Manufacturers claim that varnish should be used just as it is sold. While it is true that it is a mistake to add anything to the finer grade of varnish, the poorer qualities are often too thick to work freely without diluting. If it is necessary, add turpentine until the varnish spreads freely with a brush. After varnishing, let it stand for at least 24 hours, by which time the coat will be hard. A coat of varnish over one that is not hard will often result in *sweating*, which will necessitate scraping the work and recommencing the job from the beginning. A good many have shellac for the first coat to fill the pores.

To apply varnish properly requires a good deal of practice, and it is impossible to lay down rules that shall govern the process. The inexperienced almost invariably applies too much varnish and the result is it cracks. Where several coats are given, rub each down with fine sandpaper after it dries so as to give a smooth well filled surface for the next.

Spirit varnishes consist of alcohol and a vegetable gum as gum sandarach, gum copal, gum mastic, or a combination of mixed gums.

Alcohol and gum shellac also make a good spirit varnish. More quickly drying varnishes are said to be made of the gum cut with ether.

Linseed oil is the principal oil used in the manufacture of oil varnish. This varnish has a tendency to settle in a more even layer after spreading, although it takes longer to dry.

A wax polish proves quite satisfactory on many kinds of wood. The ingredients are bees wax and turpentine with more or less rosin added to harden the surface, but many do not add the rosin at all. A good way to prepare the wax is to melt the beeswax, and before it has time to cool, add the turpentine. Caution is necessary as both the wax and the turpentine are very volatile. As in the stain, the turpentine is merely the vehicle which enables the wax to be easily applied. In a thin condition, it may be laid on evenly over the work with a stiff brush or rag. After the wax has been spread the polish is obtained by friction, and the more it is rubbed, the brighter it will be. This final rubbing should be done with a hard, dry piece of canvas.

For most good work, French polish is to be preferred to all other finishes, as finer results can be obtained by it. It differs from varnish in that the resinous material is applied with a rubber (a hard pad of cloth) instead of with a brush. To become a good polisher, skill and practice are necessary as well as knowledge of material.

Polish requires that the pores of the wood be properly filled in order to get the smooth surface, fillers are used much the same as for varnish. After the fillers have thoroughly hardened, the laying on of the polish, which is called "bodying in" is begun. The way in which this is done greatly affects the appearance and durability of the gloss. When the body is too thin the gloss soon fades on account of the material sinking into the wood, and when the body is too thick it gives the finish the appearance of varnish.

The rubber is made of long strips of cloth rolled tightly and bound with a string or rubber band; this is

put into a double thickness of cloth, linen preferable, the ends of which are gathered up and tied. This form of a rubber is not very useful for moulding purpose. Old rubbers, if well taken care of, are better than new ones. They should be kept in an air-tight receptacle.

The process of applying the polish is somewhat as follows:—The wad is moistened with the polish and then covered with a cloth which is brought over the end smoothly, then rubbed briskly across the grain to let the surface fill, after which the work is gone over with a series of circular movements, applying a moderate pressure, increasing a little as the rubber dries. In order that the rubber may pass smoothly over the work, a drop of raw linseed oil is occasionally added to the face of the rubber. As the rubber dries, more polish is added as in the first instance. A little polish will go a long way, and at no time should there be anything like a flow from the rubber. The first *bodying in* should be continued until the wood will absorb no more, after which the rubber mark will still show but gradually disappear in the finish. The final operation in French polishing by which the gloss is put on to the body previously applied is known as spiriting off and it removes all kinds of marks. This process partakes very much of the nature of bodying in. It consists in washing the bodied surface with alcohol. The surface is gradually reduced to a fine gloss with all blemishes removed.

To make a good polish, take about six ounces of shellac and add one pint of wood alcohol; great exactness in proportion is not necessary. Shellac dissolves gradually and the process is hastened by shaking, but heat is not necessary. White polish is made with bleached shellac, common polish with orange shellac. Manufacturers of polish assert that in addition to shellac, certain gums improve the quality of the polish when properly used, but shellac is the principal ingredient in nearly all polishes. Gum benzoin and alcohol make a very good polish, but it is not generally used.—*Hawaiian Forester.*

Meteorological Data—January—March 1926.

Recording Stations & Months.	Rain-fall. Total Inches.	NUMBER OF DAYS OF RAIN: Under ·10 Inch	·10 to ·50 Inch	·50 to 1.00 Inch	1.00 Inch to 2.00 Inches	Above 2.00 Inches	Total days.	Evapo-ration. Inches	Air Temperature and Humidity. Air Temp. Maximum.	Minimum.	Mean	Humidity. Mean
Botanic Gardens.												
Jany. ...	1·93	4	7	...	...	...	11	5·27	85·4	74·8	80·1	76·6
Feb. ...	·85	6	1	...	...	...	7	5·49	85·8	75·3	80·5	74·2
March. ...	·56	3	1	...	...	...	4	7·06	86·5	76·1	81·3	69·2
Totals	3·34	13	9	...	...	...	22	17·82				
Means.	...	...	...	...	...	...	...	...	85·9	75·4	8·06	73·3
Berbice Gardens.												
Jany. ...	1·90	13	4	...	...	...	17	...	86.4	73·2	79.8	75·5
Feb. ...	·42	9	...	...	...	...	9	...	86·0	73·0	79·5	73·7
March. ...	·46	4	2	...	...	...	6	...	87·0	74·0	80·5	70·2
Totals	2·78	26	6	...	...	...	32	...				
Means.	...	...	...	...	...	...	...	. .	86·5	73·4	79·9	73·1
Onder-neeming.												
Jany. ...	2·39	...	6	2	...	...	8	...	87·0	73·0	80·0	...
Feb. ...	1·62	1	4	1	...	...	6	...	87·0	73·0	80·0	...
March. ...	·57	...	2	...	...	...	2	...	89·0	74·0	81·5	...
Totals	4·58	1	12	3	..	...	16	...				...
Means.	...	...	...	...	...	...	...	...	87·7	73·3	80·5	...
Mora-whanna. N.W.D.												
Jany. ...	1·73	13	4	1	...	...	18	...	...	...		...
Feb. ...	2·24	2	8	1	...	...	11	...	...	...	...	...
March. ...	returns	not	yet	to	hand	...	...	...	...	...	...	...
Totals ...	3.97	15	12	2	...	...	29	...	...	...	...	...

EXPORTS OF AGRICULTURAL AND FOREST PRODUCTS.

Below will be found a list of the Agricultural an Forest Products of the Colony exported during the firs quarter of 1926.

The corresponding figures for the same period dur ing previous years and the average for the eight years pre vious to that are added for convenience of comparison.

Product.	*Average 1916-23.*	*1924.*	*1925.*	*1926.*
Sugar, tons ..	20,724	12,800	12,947	20,48
Rum, gallons ...	936,760	180,614	301,355	197,69
Molasses, gallons ...	22,036	31,394	16,717	170,12
Cattle-food (Molascuit) tons	463	175	458	2(
Cacao, cwts. ...	11	None	None	Nor
Citrate of Lime, cwts.	20	None	None	Nor
Lime Juice, gals. ...	489	None	None	Nor
Essential Oil of Limes gals. ...	25	None	None	Nor
Coconuts, thousands	813	531	305	29
Coconut Oil, gals. ...	6,062	7,433	6,608	9,01
Copra, cwts. ...	520	5,237	4,159	16,16
Coffee, cwts. ...	1,898	2,290	1,779	4,88
Kola-nuts, cwts. ...	1	None	None	Nor
Rice, tons ...	3,351	1,239	2,324	1,53
Ricemeal, tons ...	14	None	None	Nor
Cattle, head ...	103	81	283	1
Hides, No. ...	1,329	2,501	3,119	2,55
Pigs, No. ...	88	122	361	12
Sheep, head ...	6	1	None	Nor
Balata, cwts. ...	2,252	3,670	2,887	3,90
Charcoal, bags ...	12,133	10,486	7,981	7,63
Firewood, Wallaba, etc., tons	2,029	1,996	1,901	1,79
Gums, lbs. ...	1,476	None	None	86
Lumber, ft ...	49,206	52,785	13,695	95,26
Railway sleepers, No	3,625	4,790	20,613	3,42
Rubber, cwts. ...	35	3	None	7
Shingles, thousands	448	157	299	37
Timber, cub. ft. ...	28,170	48,204	49,604	71,92

ATTENDANCES AT THE DISTRICT GARDEN

Year.	Bourda.	Belfield, E. Coast.	Stanleytown, New Amsterdam.	Suddie, Essequibo.	Den Amstel.	Houston, E. Bank.	Wakenaam.	Total Attendances.
1912 ...	5,514	4,395	3,302	2,100	2,544	2,156	1,718	21,72
1913 ...	5,156	4,535	2,519	3,399	2,568	1,836	1,319	21,33
1914 ...	4,243	3,869	2,443	3,025	1,791	1,653	1,533	18,57
1915 ...	1,123	1,006	769	59	503	339	401	4,20
1916 ...	4,705	1,161	1,510	225	623	2,251	1,297	12,02
1917 ...	4,991	2,820	1,366	3,297	1,186	2,564	1,663	17,08
1918 ...	4,834	3,081	1,653	2,671	2,162	2,790	2,067	19,25
1919 ...	4,769	2,425	1,582	2,798	1,851	2,480	1,556	17,46
1920 ...	6,285	2,312	1,665	2,525	2,532	3,228	2,148	20,69
1921 ...	5,671	1,968	1,642	2,629	1,949	2,539	1,610	18,00
1922 ...	3,557	1,841	1,105	1,593	1,525	1,522	1,397	12,95
1923 ..	4,038	2,780	1,595	1,934	1,953	2,137	1,951	16,38
1924 ...	4,123	2,827	1,103	1,789	1,678	2,146	1,664	15,33
1925	3,317	2,755	1,580	1,819	470	1,663	1,597	13,20